CONVENTION ISSUE

INFORMATION LETTER

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Proceedings of the 45th Annual Convention

Topics of Current Interest Discussed At General and Technical Sessions

Despite the most difficult housing problem the Convention ever has faced, operations and activities in Atlantic City from January 19 through 23 were considered successful by most people who commented. Over-all attendance was estimated by the Atlantic City Convention Bureau at about 21,000. The heavy load on available parlors and the best Boardwalk rooms made it necessary to bring canned foods buyers in ahead of the official Convention period, thus obtaining double usage of some of the facilities. For the most part, Convention delegates who had to make sacrifices in housing quantity and quality recognized the difficulties and made allowances. Members expressed themselves as generally satisfied with the program and activities of the National Canners Association in this 45th Annual Convention.

Heinz and Ratzesberger Elected

Fred C. Heinz, of the H. J. Heinz Company, Pittsburgh, Pa., was elected President of N.C.A. for 1952 and Louis Ratzesberger, Jr., of the Illinois Canning Company, Hoopeston, Ill., Vice President. Carlos Campbell, Washington, D. C., continues as Secretary-Treasurer. The membership also elected 28 Directors to new terms and reelected 44 Directors.

Resolutions

N.C.A. members voted an official resolution calling on the government to automatically suspend price controls on any product that is in ample supply and whose price exerts no inflationary pressure. The resolution urged that standards be established for removal

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1953 Convention Announcement

The 1953 Convention will be held in Chicago in mid-February. The exact starting date will be announced later.

The 1953 Convention will follow the same general pattern of that held in Chicago in 1951, sponsored by the three principal associations—National Canners Association, National Food Brokers Association, and Canning Machinery and Supplies Association. These associations will jointly assume responsibility for making arrangements for the attendance of other groups.

Owing to the increasing problem of housing because of greater attendance, various plans for rearranging the pattern of the Convention were discussed at the Convention held in Atlantic City last week. None of the patterns proposed, however, appeared to provide a complete solution to the problem. In deciding to continue in Chicago in 1953 the same prac- *(Please turn to page 18)*

1952 OFFICERS OF N.C.A.—
(left to right)
Secretary-Treasurer Carlos Campbell, President Frederick C. Heinz, and Vice President Louis Ratzesberger, Jr.

Statement on Taking Office as President

By Fred C. Heinz,
1952 President,
National Canners Association

Mr. President, fellow members of the National Canners Association, my election to the presidency of N.C.A. comes as a great surprise. I had been led to believe that there was a concerted movement on foot to keep me on the shelf until '57.

It is with deep gratification that I accept the honor you have conferred on me here today. I consider it the high point of my 35-year career in this industry.

Looking back over our N.C.A. history, I have been impressed with leadership, judgment and vision of men like the late Frank E. Gorrell, Carlos Campbell, and every single one of our past presidents, and most recently Herb Barnes. All of these men have guided the Association's activities successfully in the past and I assume with great humility the responsibility of following in their footsteps.

I can only say that I will do my best, and ask you to check with me again at this time next year.

This job, I believe, holds greater responsibilities today than it ever has before. When I say this, I do not intend to minimize the achievements of the other men who served as President of the Association. In fact, it is largely because of their efforts that the task of leading it today is so imposing. Running this organization is no longer a one-man operation. We have grown tremendously in the past 45 years, and it takes the efforts of many men to handle the thousands of problems confronting us.

What are some of these problems? They are the basic ones, which we have faced over the years, and which are still with us. The preservation of the public confidence in canned foods, which we now enjoy, the maintenance of our position in a competitive market—these and many other problems, with which I am sure all of you are familiar—these are problems which are basic and continuing.

In addition, though, there are problems which are peculiar to the times we are living in. As your President for the next 12 months, I consider it my duty to anticipate them, and to work, with your help, toward their solution. I would like to run over briefly with you what I consider some of the most important ones.

FRED C. HEINZ
1952 President

First, there is the question of prices. More than any other industry, we are caught directly between agriculture with its price supports and labor with its tremendous bargaining power. I am inclined to agree with the steel leaders when they say it is impossible to raise wages without raising prices. By the same token, I have serious doubts as to whether the price of canned foods can be kept down when two of the biggest items in our budget, price-supported farm products and floor-supported wages, keep going up. There is no question as to our importance to the people who grow for us and the people who work for us. And I am not being facetious when I say it is our duty to them to stay in business and show a fair return, without which we could not continue in business, and thus continue our important contribution to their livelihood.

Accordingly, as your President, and with the aid of the staff, the Administrative Council, Board of Directors, and our various Committees, we intend to petition for proper price adjustments whenever we think it is necessary for the welfare of this industry, under the provisions of the law or whatever other legal means exist for doing so.

The second great problem that faces us in 1952 is the matter of allocation of tin, steel, and other materials. We have a big job to do in production of canned foods for our fighting men and allies. This industry uses more tin than any other industrial group in the world, including construction and the automotive industry, and yet we have not been given the opportunity to voice our opinion on the government's program of purchase from the world supply, or its distribution and use. The interests of the canning industry can best be served if we make a vigorous presentation of proposals and recommendations in the direction of a constructive program for the purchase and allocation of this critical metal. As I see it, our big job in this respect will be to demonstrate what should be obvious—that it is just as important to save essential canned foods from waste and loss as it is to stockpile materials.

The same logic will apply to another of our problems—manpower. Here again, what happens in your backyard will depend on what happens in Korea or any of half a dozen other spots in the world. And here again, I think we can demonstrate successfully that food is vital to defense.

Of course, you will all have your individual problems in this respect, whether you're competing for manpower with aircraft plants in California or trying to work out a contract with fish packers in Maine. Many solutions will have to be made on the local level. But I promise you that the N.C.A. will be behind you to make sure we have enough workers in the industry to do the important job that is expected of us.

Still another problem—not so much a problem as a factor in our regular operations—is the Army's procurement program. This, too, I promise, will be worked out in the best interests of the industry, the Army, and the nation.

Now, it may seem to you that in outlining these problems and promising solutions for them, I am in the position of a man making a campaign speech after he has been elected. Well, I have had good reason for doing so. It is my intention always to let you know what we are doing in the name of the Association. I make this my intention because I know I cannot succeed without your help.

I ask all of you to show the same confidence in me throughout the year that you have shown me today, and I will do my utmost to deserve it. In particular, I will need the cooperation of the staff, the Board of Directors, the Administrative Council, and all Committees, as well as the membership.

With this cooperation, I hope to justify the trust you have placed in me. Thank you.

Convention Proceedings

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of price controls when goods are abundant and not creating inflationary problems, stating that most canned foods are in that position on the market today. The Office of Price Stabilization was urged to promulgate regulations immediately that would provide for suspension of controls under such conditions and it was stressed that decontrol standards be specifically clear, direct, automatically operative and based on economic fact.

Another official resolution urged "immediate and clear Congressional confirmation of the legal right of every seller in good faith to price his goods so as to be enabled always and effectively to meet competition". The resolution pointed out that uncertainty in the legal rules governing the right of an individual seller to meet competition constitutes a threat to the economy.

Canners' Contribution to Defense

President H. J. Barnes' remarks opening the Convention pointed out that the industry is once more demonstrating, through high production and cooperation with defense requirements, and by the skill and ingenuity of its technological practices, its ability and desire to contribute importantly to the nation's defense effort. Mr. Barnes received a standing ovation for his remarks and was again warmly applauded later in the program when, on behalf of the Association, Fred M. Moss, of the Idaho Canning Company, came to the platform and, with fitting remarks of praise and appreciation, presented the retiring President with a handsome Swiss watch, appropriately inscribed.

CARLOS CAMPBELL

Secretary-Treasurer

Important Washington Speakers

At the Opening General Session, with Mr. Barnes presiding, the canners heard an address by The Honorable Wallace F. Bennett, U. S. Senator from Utah, Mr. Barnes' home state. Senator Bennett charged that the government's attitude toward business is a threat to the free competition that has given this country a standard of living undreamed of in history. His theme was that government should be a partner, not an antagonist of business. Ralph S. Trigg, Deputy Administrator of the Defense Production Administration, was the second guest speaker of the morning session. He reviewed the progress of defense preparation, touching particularly on the strategic materials essential to canned foods production. He reported on provisions of the latest amendment to the can order, M-25.

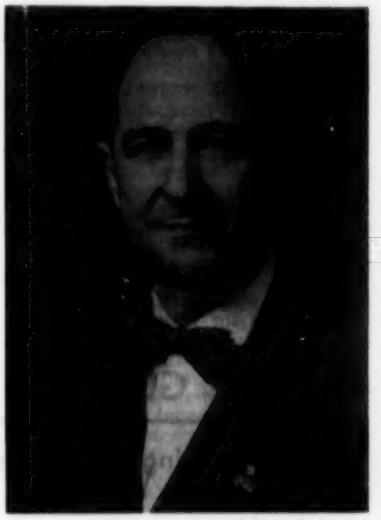
The Closing General Session, Saturday afternoon, was the occasion for the installation of the 1952 officers of N.C.A. In his statement on taking office as President, Mr. Heinz pointed to certain of the basic problems facing the industry—preservation of public confidence in canned foods and maintenance of the industry's position in a competitive market. In addition, he stressed the importance of recognition by government of the essentiality of canned foods in the defense effort to ensure that strategic materials vital to volume production of the canning factories are not denied to the industry. He pointed up also the necessity for orderly and business-like handling of pricing problems. Government control problems made up the balance of the program of the General Sessions.

Armed Service Requirements

Colonel W. E. Pheris, Chief of the Procurement Division, Office of the Quartermaster General, spoke on proposed requirements and plans for the canned foods supply to the armed forces in 1952. He commended the canning industry and the Association for its cooperation throughout the past year. He stated that Quartermaster procurement planning this year contemplates four steps: (1) the set-aside program, (2) the Walsh-Healey exemption, (3) negotiated purchasing using letter contracts initially, and (4) a field buying organization. At the conclusion of his speech, there was released in the N.C.A. Press Room at Hotel Traymore and simultaneously across the nation, the tentative 1952 requirements for canned fruits and vegetables. (See page 26.)

USDA Production Goals

S. R. Smith, Director of the Fruit and Vegetable Branch, Production and Marketing Administration, U. S. Department of Agriculture, discussed agriculture production goals for 1952 and performance in 1951. On the performance side he gave the canning industry credit for doing "an outstanding production job in the face of many uncertainties". The 1952 production goals, announced by USDA just prior to the Convention, suggested about a 2 percent smaller acreage for processing vegetables than in 1951 and about 15 percent less production from that reduced acreage. No goals are set on canned fruits and juices, Mr. Smith stated, but expectations are for a canned fruit pack somewhat smaller than last year's record. There will be a reissue shortly of legal minimum prices for vegetables where the increase was based on 1950 prices, but the Department, he said, is not contemplating a reissue for canned fruits.



LOUIS RATZESBERGER, JR.

1952 Vice President

Canned Food Pricing Program

George L. Mehren, Acting Director, Food and Restaurant Division, Office of Price Stabilization, reviewed the agency's performance in the issuance of the several price regulations that controlled the canning industry during 1951. The agency was able to cover nearly the entire canned foods field, he stated, a large number of commodities in an immensely complex industry. He said that plans are now well settled for the formulation of regulations in 1952. Major changes in structure of the regulations will be avoided, he asserted. Consultants have been at work preparing these regulations, but resolution of several issues is still ahead—whether or not to retain 1948 as the base period, proposals for the pass-through of raw materials increases up to parity level, use of 1951

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tice of having all groups in attendance simultaneously, recognition was given to the fact that this pattern has been evolved from 45 years of experience during which the type of Convention that provides the greatest amount of interest and satisfaction for all groups has been developed.

Thus, it is believed that the physical problem of housing all groups simultaneously, which has been the principal reason for trying to develop a different method, should be solved if at all possible without altering the Convention pattern that has proved most satisfactory.

The solution of this physical problem will necessitate a more rigid control over assignment of rooms and other hotel facilities. It may involve rationing of rooms and parlors according to some priority system. Furthermore, it is planned that tentative allocation of hotels and rooms to the various groups will be made much earlier this year than in former years so as to provide time for adjustments necessary to insure equitable housing of all.

GENERAL SESSIONS

Greetings to the Convention Delegates

By H. J. Barnes, 1951 President, National Canners Association

I wish there were enough years to go around to enable every single member of the National Canners Association to serve a term as its President. It is the most educational opportunity that could come to a canner. He enjoys the privilege of meeting hundreds of canners in all parts of the country and learning of their particular problems and achievements. He makes a wide acquaintance with officials and leaders of other trade associations—the state groups, the allied trade organizations. He discovers how wide the scope and how essentially dovetailed are the interests and activities of all those who supply, produce, and distribute canned foods and who join hands in this major contribution to the high living standards of this Nation and the wide world.

But most illuminating is to ascertain how vast, how constructive, and how inspiring is the performance of the National Canners Association. It has humbled me to consider that while a President's term encompasses a year or so, the Association has been carrying on scientific research that had its beginnings nearly 40 years ago. It continues with statistical, economic and information services that have spanned two or three decades. Practically all of its numerous professional activities, which have steadily piled up acceptance and prestige for canned foods, have been going on without cessation for longer than the present generation of canner-members of this organization. Many Association services had their genesis way back in the days when my late father was an active laborer in the N. C. A. vineyard. There are some in this room—third generation canners—whose grandfathers obtained benefits from N. C. A. activities.

H. J. BARNES
1951 President

My reason for emphasizing that the institution is greater than the individual is my fear that too many members in these pressing times of government control are likely to forget that there are other constant services being rendered by N. C. A. Work which at any given moment is a subject of industry interest—like pricing problems, container limitations, or availability of manpower—is being performed by the Association as a matter of course, and so also is work that is perhaps of prime personal momentary concern to an individual member—like a consumer complaint, or a processing difficulty, or a label text. But what we are apt to forget is that in the meantime a multitude of regular activities are going on, day after day, without pause, and in increasing volume as populations and packs continue to grow. These are constant in the various Divisions, and they are of long-time importance to the canning industry.

I strongly recommend to every member in this room that he read a book that it has become our sorry habit to neglect. I refer to the *Annual Report of the Secretary*. If you can't learn, as I have this past year, by serving as President, you'll find out from that report that the imposition of heavy added duties on the various departments of the N. C. A. staff has not curtailed nor slowed the continuous performance of its regular duties. The dissemination to the membership of information about government regulations, mounting during the past year, has been handled in its stride by the staff, and at the same time they haven't missed a single beat in the performance of the duties that were assigned to them long before anyone dreamed of federal rules for the conduct of a man's business.

I, therefore, make this public acknowledgment to the staff for a stellar performance this past year under trying conditions. I bow also to the members of all Committees who have served this past year, and especially do I wish to thank the members of the Board of Directors, the Administrative Council, and the War Mobilization group with its various task forces on the several phases of government control. These men have devoted monumental time and labor to their pressing tasks. They have traveled thousands of miles by rail and air to meet the problems as they arose several times during the year. Their faithful and efficient service has made my job and responsibility as President that much easier to carry. I give them full credit for successful guidance of the industry's mobilization effort.

The canning industry has demonstrated once more how it can and does respond to calls for support of its government in emergency. Our production this year has established an all-time high in the history of canning; we have met and more than matched the demands made on us to provide vital foods for our armed forces and trainees; we have not permitted the impediments that sometimes arose from regulatory restrictions to slow down this contribution from an industry that is so essential to any defense effort.

And finally, we have performed our usual meritorious service to the public in the marketplace. We have shown that through the skill and ingenuity of the industry in its technological and business practices, kept keen and alert by the highly competitive atmosphere in which we function, we can offer the housewife valuable and desirable foods at prices that strain her budget less than other commodities on the retail shelves.

Government and Industry—Partners or Antagonists?

By The Honorable
Wallace F. Bennett,
U. S. Senator from Utah

I consider it a great personal honor to be invited to address you at this particular time as the very successful year of the presidency of my friend, Herb Barnes, comes to an end.

I am particularly happy to be here this morning so that I can see at first-hand by what a strenuous and perilous system a man comes to the presidency of this organization.

And I am glad to know that my friend, Mr. Heinz, was not ultimately disappointed because when he called on me in my Washington office about ten days ago, I know he was hoping you would honor him with this election this morning.

Mr. Heinz, I am happy it came out that way. Of course, I feel perfectly at home because in all the other associations in which I have been similarly bludgeoned, the process has been about the same. And I assure you, it is nothing at all like the process by which a man comes to be United States Senator. That is something else completely.

When I was asked to fill this position briefly this morning, it was suggested that I say something about the relationship between government and industry, having had experience in both of them. But I think it is a little tragic in America today that it is possible to suggest as a title for such an approach, "Government and Industry—Partners or Antagonists?"

To the traditional, mythical man from Mars, who is presumably so far removed that he has an objective viewpoint both in time and space, the answer to that question, looking at American history, would seem obvious. Government and industry are properly partners, not antagonists.

Industry is nothing but men and women at work; working with ideas and materials to build a higher standard of living for themselves and their fellows. And government is nothing but the same men and women working as citizens to create the atmosphere in which that prosperity can be built and maintained. Of course, I realize that material prosperity is not the ultimate goal and end of life. It is not a true translation of that famous phrase, "Life, Liberty and the Pursuit of Happiness," and to a certain extent one of the weaknesses of our present American situation is that materialism which translates prosperity into the ultimate goal, is one of our handicaps.

There is another tie of partnership between government and industry in a land whose economic system is based on private ownership, a tie that too many people do not realize. This tie grows out of the fact that all governments gain material support by taking a share of the income of the men and women whose ultimate source of income is the business and industry of developing the natural resources of a nation and transforming them into a myriad of forms and shapes which make up the manifestation of our material prosperity.

Every school boy and girl realizes that this nation was born in defiance of antagonism between government and the men and women who made their living in industry. They can all tell you about the stamp tax and the Boston Tea Party which were manifestations of revolt against the attempt of an all-powerful distant government to interfere with the ways by which men in our little colony made their living. And, of course, the history of the settlement of this continent by the men and women of this nation is the history by which government followed trade and industry across the continent. We used to say that "the dollar follows the flag." Now the flag follows the dollar.

In the inter-mountain country from which Herb and I come, the first representatives of this commonwealth who penetrated that wilderness were traders seeking furs, not mink. These men penetrated that part of the continent which at that time belonged to a foreign sovereignty, and it was their story that created the determination of this nation to secure that territory for its own people in spite of the fact that the great Daniel Webster is supposed to have said a hundred-odd years ago that he wouldn't risk a single American life for that great desert which is now an important part of our national economy.

We do not need to spend time detailing the history of the development of this continent on the heels of trade in industry. It is enough to point out that during these early years the pattern of our geography was set and that the great cities that have grown up in the middle west and far west, particularly, grew up where the first traders established their trading posts. It is enough to look back to the past decade to realize how important industry and commerce is to the life of our government. Ten years ago we were faced with the threat of the second world war. It took 10,000,000 of our young men out of our economy, and those of us who stayed behind thought we had a rough time of it. But compared with the men and women who lived in countries over the waters, we had an easy time of it. And our industrial and commercial capacity was great enough, not only to keep us living in comparative comfort through those perilous times but to build a mountain of war material with which we eventually overmastered all the productive capacity of Europe and Asia and then destroyed it.

Then if that were not enough, when that adventure was over our productive capacity was great enough to restore our own people to their accustomed level of prosperity and, at the same time, provide enough more to rebuild the economies of the nations which in war we had to destroy. Of course, we did not do that simply by repeating the old products that were available to us at the end of the thirties. During that time we created in our laboratories and off the engineering drafting boards a tremendous variety of new things. And if that were not enough, we didn't produce these things at the usual cost—at the cost that had marked the cost of the thirties. I am told that your industry today can provide 70 percent more canned food for the present take-home pay than was provided 12 to 15 years ago.

And if that were not enough, on top of all that, we provide directly today 40 percent of the cost of a government which is taking at least 25 percent of the total production. Of course, what the American people do not realize is that American productive capacity—both agriculture and industry—provides the total cost of that government because it draws income from no other source. There is no other source available but the production and the savings of the American people.

On that record, which has been built up on a system of private ownership with the power of individual initiative behind it, I am sure you would expect that government, representing the manifestation of our citizens in their citizenship as contrasted with industry, representing them as productive individuals, would be concerned in preserving and strengthening the partnership between these two factions of our great life. Instead, for two decades now there have been powerful forces at work in America, particularly at work through our government, apparently determined to impede and obstruct, and maybe in the ultimate end, to destroy our present pattern of industrial production. Certainly they have succeeded in discouraging those people who would invest their savings in American industry. But industry is tough. At least the present generation of businessmen are hard to stop. And in spite of all these obstructions, we have gone ahead to the accomplishments that I have so briefly tried to outline to you.

Let's stop for a minute and try to analyze the source of this attempt to create antagonism instead of partnership in industry. It comes to us from many different sectors of our

life but I would like to point out two of the more obvious sources of this attempt to develop antagonism.

I am oversimplifying, I am sure, but the first would be identified in any other country as socialism and the people who advocate it as socialists. But that word is not acceptable in our country and so they take other names, particularly using the word "liberal" to indicate an advanced ability to understand our American problems.

These people—many of them—apparently sincerely believe that our productive capacity would be used more successfully if it were owned and controlled by the government as representing the people, rather than by the people themselves as direct producers. So they would like to nationalize our industry, they would like to set up a form of government which would replace, as operators of our economy, the millions of present businesses which working together have produced our prosperity.

Many of these people are in government, some of them I am sure attracted by the realizations that they are either unwilling or incapable as individuals to face the competitive risks of commercial life, and they would hope to create a government monopoly of which they could become the operators and directors. Many of these people are outside of government, in those functions of our life that are not directly connected with business and industry—in education and journalism, in other professions who draw their sustenance from the productive power of our people in industry just as government does—but who don't realize or are unwilling to admit their dependence on it and who would like to make it over.

These people realize that the American people would reject such a program if offered on its merit. And so, for too many years now we have seen them boring from within, attempting to whittle off a little here and a little there to increase our restrictions, to increase public ownership of this or that phase of our industry. They have been reasonably successful in some parts of the country in the field of power. They haven't been particularly successful when they get directly into the productive industries themselves. But don't think they stop.

If any of you happened to read the bill which the President sent up to the Congress last year to be adopted as the Defense Production Act, you will realize what great amendments the Congress made in the bill and what great powers the President asked for and was denied, including the power to take any property in the United States without going through the present laborious process of condemnation. He could take it first and let you go to court afterward to secure your compensation. He wanted the power to put the federal government into any business, set up as many corporations as he pleased for any purpose, and to back these with the entire credit of the American government. These things were denied him. But the pressure is still there.

Federal medicine hasn't occurred. I don't think it is possible to get a bill for it through Congress. But Oscar Ewing has a program to get into it a little bit at a time by increasing the variety of services offered under Social Security. His next proposal is to add hospitalization as an adjunct to Social Security.

And so it goes. Whenever we are weak, whenever we falter, whenever we turn to government for help, there are those in government who would

Sen. WALLACE F. BENNETT

take advantage of our weakness to further impose this philosophy of socialism on the American people. I am one of those who believe their chance has passed with the distressing example of socialism in action across the water. The American people, I am sure, are not even so interested in socialism as they might have been five or ten years ago. But that doesn't mean that this relentless pressure to win it a little at a time has been dissipated.

But these people are not the threat in creating antagonism between government and business as are those of us in government who might be described as practical politicians, people who look to government as a career, who realize that under our American system they must be elected and who seek issues and programs which will attract the majority of the voters. At this point in American history we have been living under the administration of a single party for 20 years. That party came to power at a time when our economy was struggling in the throes of a depression, when the American people had lost their faith in business leadership and were inclined to blame business and industry for the difficulties in which our economy found itself. The politicians who won those elections in the thirties discovered it was popular to belabor business and to blame it for the difficulties the American people wanted solved. They found it popular to suggest that government could solve those problems by itself, not only without the help of business but in spite of business. And that type of political propaganda has been very successful.

It was carried into the campaign of 1948 and the President, who is credited with having won his own reelection singlehandedly, did it. He did it by belaboring and castigating business, particularly business and organizations like this. And if he is the candidate again, I think we will find the same process continued.

But that is just campaign talk. There has been one effective political program that I think more than any other has helped to contribute to this gulf of antagonism. I think it was deliberate, I think it was very successful. And that was the campaign which divided the men and women who earn their living through business and industry into two antagonistic camps, and separated the men who work in the shops from the men who work in the office, and the men and women who provide the capital without which there would be no jobs in the shop. These people lost some of their faith in their leadership within industry in the early thirties, and this has been deliberately diverted to other leadership, leadership that on the face of it is dedicated to the improvement of the conditions of these people in their relationship with their employer, but in active politics has demonstrated that it is often more interested in using the rank and file of its members for political preferment.

There has been another program developed within the last few years, probably I think, the result of the success of the first. The old adage, "divide and conquer", is still a good one. But having been so successful in separating the management side of business from the workers' side of business, they are attempting to drive another wedge, this time into business itself. We have seen grow up in Washington a cult which says that small business is virtue, and big business is evil.

I had the very interesting experience in the debate on the floor in the Senate last year when we were discussing the amendment of one of these bills that regulates business, in being told that the bill would never be applied to little business and the little business-

men need not worry if it were enacted into law. It was intended only to apply to big business. If they succeed in driving that wedge then, of course, business and industry have been effectively divorced and the partnership will have been pretty effectively destroyed.

But because I spent most of my adult life in business and only a very limited time in the process of government, I still sense that the partnership is fundamental and I am still concerned with what can be done to restore it, at least to restore the government's realization of its existence.

I am going to suggest three things briefly.

The first has particular meaning at this time. In order to sustain an attack against business leadership, it is necessary, of course, to have horrible examples to which to point. It is necessary to be able to prove that there are men in business and industry who are evil. And, of course, there are, just as there are such men in every other walk of life.

Organizations like your Association have done a great service already. They still have a great service to perform in raising the moral standards in the practices of industry. I think industry in its relation to its customer has a very high standard but every once in a while somebody gets off of it, and there must be public opinion within industry to act as a deterrent to that kind of thing. Since the mink coat stories began to grow out of Washington, one of the defenses of those who are involved is, "well, there are always two people that have to be guilty in that situation." The fellow who gives the bribe as well as the man who takes it. And the inference is that business is equally guilty because from its ranks come people who attempt to buy influence. It has been my observation that the people who are labeled as businessmen in those situations are not the people who belong in this kind of an organization. They are the fellows who are always on the lookout for a fast buck. They are the people who attempt to exploit industry as they attempt to exploit government, and they are not found in the ranks of the men and women who year in and year out operate the fundamental, continuing processes of industry.

So that is the first thing that we in industry must do. We must make sure our house is clean and that it is properly performed.

The second thing is more difficult. We must heal this breach between—to use the words that have been used to create the breach—between "management and labor." And I am sure it cannot be done by resolutions passed in meetings like this or by programs that grow out of the committees through which Herb Barnes referred. It can only be done where men and women work together in the same establishment on the same job.

We have done a swell job in industry in persuading our customers that our products are good and in telling our customers all about them. If we could do the same job with our own employees in helping them understand what business is and how it operates, and if we had the courage to do it by telling them the facts about the very business of which they are a part, I think we could heal that breach and we, who have the responsibility for leadership in industry, could claim the leadership of the people who work with us. And until we do that, the politicians will see an opportunity in that breach and will do everything they can to maintain the antagonism.

Third, there is a great need for men with business experience in government. Mr. Trigg is going to talk to you about the problems of the Defense Production Administration. I am sure that organization has had to draw heavily upon industry to find men who could understand the tremendous problems that it faces. And the same is true of its companion agency, the Office of Price Stabilization. And to the extent that men with sound business backgrounds from all industries have been used in these agencies, they have been successful, and to the extent that decisions are being made by people who only have a theoretical knowledge of industry, they create situations that have to be changed and amended.

This is still a free country. Once every year at least we have an election for some kind of an office—state, local or national. Every two years we reelect the entire House of Representatives and one-third of the Senate. Every four years we elect a President of the United States. The right to vote is a great and cherished privilege. But it is only the minimum manifestation of our responsibility as citizens. We have the responsibility to take part in the process by which these representatives of ours are selected and elected.

Many of us in business have been bluffed out. We have been persuaded that it is illegal for a businessman to take part in politics because it is illegal to use corporation funds. But you have just as much right to express your political opinion as any other American, and if you believe in the fundamental partnership of industry and business on the one hand and government on the other, you will realize that the voter is the bridge through which that partnership operates. And you will be concerned, as I was, with the participation of men with business backgrounds in the election process. I eventually find myself officially out of industry and over on the side of government. I hope there are men in this Association who can make that step either through election or through service in some of the administrative agencies. But if you can't go that far, will you at least, and particularly, in this year ahead, regardless of your party, get busy now and see that the men, who represent your district or your state or your precinct, are men who understand this relationship and in whose judgment you can trust.

If American business and industry, on the one hand, and American government on the other, are to go into the future with attitudes which will result in ever-widening breaches, then there is one inevitable result, our present system of business and industry will be destroyed and replaced by another and our present government will go down with it. And the resulting partnership will be something that none of us would like.

I don't think that will happen in our lifetime. But we may be, by our neglect, imposing it on our children. I hope we can find time in the months ahead to work at these jobs, to work with our industry, to work with our employees, to work with our fellow citizens to reestablish this vital partnership.

Strategic Materials in the Mobilization Effort

By Ralph S. Trigg, Deputy Administrator, Defense Production Administration

We are now approaching the midpoint in our entire mobilization program and at the outset, I want to make one point perfectly clear. The year 1952 will unquestionably be very difficult for many of us. It will be difficult because material shortages will be more acute in the coming months, and because the visible rewards of our mobilization for defense—in the form of mass production of munitions—is still some months distant.

The basic policy we have been following since our defense mobilization program was first established a year and a half ago is still unchanged. This policy has been stated many times, but I think it cannot be repeated too often for it helps all of us to put our whole effort in a much-needed perspective.

Briefly, that policy is this: We are determined to make our nation strong enough to make the communist aggressor think carefully before plunging the entire world into another world-wide conflict or, failing to pre-

vent that war, to make ourselves and our friends in the free world strong enough to win any war that may be forced upon us.

It is essential to keep this policy constantly in mind. Without it, our whole mobilization program becomes meaningless, and I would be the first to agree that those of us in Washington and elsewhere engaged in building up our military and economic strength might better devote our efforts to some other task. But when you consider the task that we have to do, then our work takes on a renewed importance and significance.

Now, it must be obvious to all of us that we cannot attain this objective without a considerable cost to ourselves. We are now feeling, and in the months ahead we shall continue to feel with increasing severity the inevitable dislocations, material shortages and localized periods of unemployment that are the inescapable cost of any mobilization program.

With this brief, and I must admit rather somber, recitation of the task that lies ahead of us, I should like to switch briefly to a review of some of our major accomplishments of the past year.

All of us who are connected with the effort to rebuild our military might can take a great deal of pride in the achievements of the past year. They have truly been tremendous.

During this year more than one million men and women have been added to our armed forces. The Air Force has added 28 wings and today has a total of 90 wings. The number and strength of the Army's divisions have increased. The Navy has returned more than 270 vessels to active duty from the "moth ball" fleet.

We have reached a rate of about $2 billion a month in military deliveries and construction—more than three times the rate of a year ago. On some major items, we have already reached our planned peak production rates. Total deliveries since the Korean outbreak for our own forces and for mutual aid have reached nearly $20 billion.

We have launched expansion programs in those sectors of the economy where greater production is needed to support a sustained military production effort and a healthy civilian economy. Some of the benefits of these expansion programs have already been felt. During 1951, for example, our steel capacity increased by 4 million ingot tons annually, our aluminum capacity by 75,000 tons annually, and our electric power capability by more than 7 million kilowatts.

We have laid the foundation for a much greater expansion both in military production and in basic industry, which will come in 1952 and 1953.

And we have done all of this with relatively little dislocation of the civilian economy. We have had relatively little unemployment, and few business shut-downs. Since early this year, inflationary pressures have been held in check successfully.

On the international side we have made great strides in developing the basis for effective cooperation among free countries all around the world. Our allies are making progress in their defense efforts, and our military-aid program is gathering speed as the decisive factor in the arming of vulnerable lands in many parts of the globe.

So much for our accomplishments. While the outlook for the remainder of this year is not completely clear, we can be sure that the "pinch" on critical materials will continue into 1953. As we now see it, the requirements of the military and the atomic energy programs for most materials will either continue at the same levels throughout 1952 or rise slightly. The production of steel and aluminum should also rise somewhat during the year, but the main results of the expansion programs will not be felt until late in 1952 and 1953.

After military and atomic energy needs are met, our objective is to divide the remaining supplies of steel, aluminum and copper—the basic materials allotted under the Controlled Materials Plan—in such a way as to best serve the defense mobilization program as a whole, including industrial expansion, consumer goods, public services, limited export requirements, stockpiling and so on.

That brings me to the heart of a matter that is very close to me, and which I can speak about with a great deal of authority, because it is the part of the defense program over which I happen to have direct responsibility. I am referring to the over-all division of controlled materials—steel, copper, and aluminum—among all of the various claimant agencies.

It is the function of the DPA Office of Program and Requirements to "cut the pie," to make each quarter the fairest possible division of these basic materials, in line with our policies and basic objectives. Believe me, it is a big job, and one that brings many headaches and little praise.

The basic difficulty, of course, is that we don't have sufficient supplies of the basic materials to satisfy all demands. There just isn't enough to go around, and cuts have to be made somewhere. The result is that when you come right down to it, no one is really pleased. No one gets all of the materials he thinks he should get, or as much as we would like him to have. No one ever comes to me with cheers for the fine job we have done in dividing up the pie, in allotting materials. Instead, they all want to know why they haven't gotten more. And I suspect that you gentlemen are in the same boat as all the rest.

Let me make it clear that I have no quarrel at all with any of the 50-odd claimant agencies. I have said many times that I think each one of these claimants would be derelict in its duty if it did not press upon us the urgency of the programs under its jurisdiction with all the force it could muster.

But again I must ask you to remember that we are faced with a very great responsibility. It is our job to see that we achieve the soundest possible balance between limited supplies of critical materials and the needs of these materials in the various phases of the defense effort. This means the developing of a balance sheet for the entire economy, and determining the relative essentiality of different programs. In simple terms, it means that we have the job of seeing that available materials go where they will contribute most to both immediate and long-range needs.

A first step is to draw together and total up the estimated requirements for all uses. In this we have the help of many other agencies upon which we depend for initial determinations. There are some 56 of these "claimant agencies," each responsible for an important segment of the total economy. A few of the more important are the Department of Defense, for the military program; the Department of Agriculture, for needs in agricultural production, processing and distribution; the National Production Authority, with its motor vehicle, farm machinery, and other special divisions; the Defense Fisheries Administration; the Petroleum Administration for Defense; the Defense Electric Power Administration; the Defense Transport Administration; the Defense Minerals Administration; the Maritime Commission; the Federal Security Agency, for schools and hospitals—and so on through the long list.

With the aid of an inter-agency Requirements Committee, all requirements submitted by the claimant agencies are screened and re-screened. They are double-checked against relative essentiality, possibility of deferment, any duplication of coverage, and other factors which would influence final decisions. Top-level officials make up this inter-agency committee, and you can be sure that requirements in all phases of the economy get a thorough hearing.

A second step is, of course, to determine the total amount of scarce and critical materials which will be available in total for distribution and use during the period under consideration. Here again we have direct help from many other agencies and services. These determinations must be factual and accurate, based upon the best possible information.

When the estimated requirements are reported and translated into tons of steel and copper and aluminum—and the total availability of the critical materials is known—then the

real job begins. The problem centers in the fact that there are not enough of some of the most important raw materials to meet even the carefully screened requirements which have been requested by the claimant agencies. There is only one answer: all requirements cannot be met in full.

Here is where we undertake the difficult but necessary task of cutting back on requirement estimates, deferring the fulfillment of some programs to later periods, and suggesting all possible ways of conserving critical materials through substitution and elimination of waste.

In reaching final decisions on allocations which will bring requirements into balance with available supplies, we are guided by three basic policies: (1) the material needs of the approved military program should be satisfied in full, after careful screening to eliminate errors, duplications, waste, and any improper scheduling; (2) the material needs of defense-supporting activities should be satisfied, after similar screening, to the maximum extent consistent with the limited amounts of steel, copper, and aluminum available for distribution, and consistent with securing a proper balance between construction and equipment, between components and end products, and between the production of energy resources and the demand for these resources; and (3) production of consumers' goods should not be subject to sudden, drastic cutback, because of the great danger of creating pools of unemployed labor and contributing to inflationary forces; but it should be curtailed to the extent necessary to free critical materials for more urgent defense uses.

We have just finished making the second quarter 1952 allotments of controlled materials among the various claimant agencies, and I should like to discuss some aspects of this distribution in some detail.

In the first place, when we drew up our first balance sheet, the stated requirements of the various claimants were from 137 percent to 185 percent of the supply and these requirements had already been screened and represented the minimum amounts that the various claimant agencies felt that they must have to carry forward their most essential programs.

More than this, the requested direct and anticipated indirect requirements for the Department of Defense and the Atomic Energy Commission not only increased over the first quarter, but were very large in relation to the supply.

You can see from this something of the problem that we faced. Demand had to be brought into balance with supply, yet we had to meet the essential needs of the military and Atomic Energy Commission, and at the same time maintain the civilian economy at the highest possible levels.

Our policy is to support civilian production at a "protected minimum" level which will not create shortages of important equipment, appliances and other goods and which will not result in widespread unemployment and which will not jeopardize economic stabilization objectives.

This was a very large order, as you can see, and I will not pretend for a moment that we met it in full. I am sure that we have not. But we have tried, and I think we have succeeded very well in making the fairest distribution of materials that could be done, consistent with the material shortages and other problems that we faced.

RALPH S. TRIGG

Remember that in weighing the needs of any one program, we must also consider the needs of others. I want to assure you that we are very mindful of the importance of the canning industry. I want to assure you that we will do all that we can to see to it that the essential needs of this industry are met, so far as we can meet them. But this period requires some sacrifices from us all.

Never before on so vast a scale has any nation attempted to build military strength and at the same time expand its basic economy, maintain high levels of production of consumer goods, and assist in the arming of allies throughout the world.

It is a bold and challenging program. Its requirements for many basic materials and for highly skilled labor are very great. It places great demands on the leadership and organizing ability of industry and government alike. It calls for a large measure of devotion and unity among our people.

We in the Defense Production Administration feel that the limitations and controls which are necessary now are merely temporary expedients. We do not think it will be necessary to continue them indefinitely; we do not want to continue them one hour beyond their actual need. And as the industrial expansion program moves toward completion, we are confident that the emergency restrictions can be relaxed more and more—toward the day when they will no longer be needed at all.

The governments of the United States and Great Britain have been working out some agreements on things they have and we need very badly.

Why do we work as a partnership with countries like that? Because they have many of the critical materials that we need and we have many of the critical materials they need.

I think the announcement that came out of Washington yesterday that we have finally agreed on some 20,000 tons of tin to come into this country in the very near future is of most significant interest to you people here today because it is something you have got to have if your industry is to carry on. That is a big help and I, personally, am glad to see that we finally obtained the tin and we can be looking forward to having some more tin available when it comes time to divide up these raw materials.

We are trying to expand all of our natural resources and, as I have mentioned, one of the ones that really gives us a headache is copper. Copper seems to be one of the real critical materials in the world today. We are getting a lot of copper from foreign countries—from our friends abroad, but we still have a much higher demand for copper than we have supply. We can hardly expect to get an increase in the electric power program throughout the land if we do not have copper to go into the generator, into the wiring systems and other things.

We are having terrific demands on the copper supply from the military. In terms of all of it, it means we have a demand for anywhere from 120 to 200 percent of our supply, thinking in terms of copper, aluminum and steel, and those are the three control materials of the Controlled Materials Plan.

It isn't easy to make the decisions that we put 50 percent of it some place else, or some place in connection with the military program and the rest of it has to be divided equally in order to keep the economy going.

Those are the things that have to be done. They have to be done by someone, by some group of people and

that is what is being done by the Defense Production Administration.

You heard Senator Bennett speak about the fact that a lot of people from industry are in Washington working with various government agencies, particularly in the National Production Authority and the Defense Production Administration. That is true. And let me say this to you. When you are called upon as an industry or as an individual firm to send some one there, send the very best man you possibly can—the very best man, if you can let him go. It is important to you and it is important to us that we get the detailed, intimate knowledge of the industry if we are going to do any sort of a job in guiding industry and government through these perilous times. So I, for one, would like to ask you that if you are called upon, give us the best people you have. They will learn a lot and it will be a lot of help to you when they return to your business. But we cannot administer these programs unless we have intelligent leadership, unless those of us who might be called government career people have the advice and consultation of people from the industry. There are a lot of those people in Washington today.

One of the policies I don't like is that we only keep them six months in most instances. Actually, it takes a man three or four months to find his way around Washington and after that, about the time he learns his job, he is ready to go home. It doesn't contribute the most and we need the most at this time.

Mobilization is a job between industry and government. It can't be anything else. It would be utterly ridiculous and impossible to administer these programs solely with government people. I would be the first one to vote against any such idea as that. It is also impossible to administer it solely with people from industry who can only remain in Washington for a few months' time. So there must be some balance between them, and we want, when we ask you, the best people you have. We have drawn from a lot of industry and there are a lot of people in Washington who are doing a magnificent job.

I would like to pay tribute to who I think is one of the great men who has come from industry to administer this total mobilization program, and that is Charles Wilson of General Electric. I think he is truly one of the great men of the country and I must say he is doing a grand job. He is trying, at least, to look at all of the problems with some sort of balance regardless of whether it is industry, government, the general public, or just what. I think he is a very fair individual and I think that industry is to be complimented upon turning up such a man in an emergency such as this.

Again let me say, it has been a real pleasure to be here, and I want to thank you again for asking me. But before I close I do want to give you what might be said just a little bit of good news. After all, we talk always in terms of "down the road it is going to be tougher," and it will be worse for you in the coming months. But we have made some headway in administering these programs and we have made some headway in increasing our productive facilities. We made a little headway yesterday in getting out a regulation. We have amended M-25, which most of you are very familiar with. The quota for some of the items in M-25 have been raised from the 70 or 90 percent up to 100 percent of the use for the base period. That takes into consideration, particularly, some of those low-cost basic food items, as well as others. That will become effective as of January 1. The amendment is something a lot of you people have been interested in for some time. It is something that has been recommended by the Department of Agriculture, and it is just a question of finally getting the amendment approved. It will be out on Tuesday.

Amendments to M-25

Following are the changes in can specifications listed in the can order, M-25, as amended January 22, and effective January 1:

Product	Quota Percentage from	to
46. Beans, dry soaked, all varieties	90	100
146. Chili con carne, with beans	90	110
146. Chili con carne, without beans	120	110
206. Macaroni, noodles, and spaghetti, wet pack	90	100
219. Soups, liquid, nonseasonal	90	100
219. Soups, liquid, nonseasonal: chicken broth	70	100
224. Spaghetti with meat balls	90	100

Product	Soldered Parts from	to
154. Hamburger, including meat balls, with or without onions, with tomato sauce	.25	1.25
219. Soups, liquid, seasonal: asparagus	.50	1.25

Product	Non-Soldered Parts from	to
56. Carrot juice	.25	1.25
219. Soups, liquid, seasonal: asparagus	.50	.25

Military Procurement of the 1952 Annual Pack of Canned Fruits and Vegetables

By Col. William E. Pheris, Chief of the Procurement Division, Office of the Quartermaster General

Mr. Heinz, it is a pleasure to appear before your Association. And to bring you the good wishes and appreciation of Major General George Horkan, The Quartermaster General. The wholehearted cooperation of the National Canners Association is thoroughly appreciated by the Quartermaster Corps for you and your organization have been completely a team with us providing food for the Army.

When Wellington began the modern system of supply in Spain, little did he realize the problem would become so big. Nor did he have so many ways to solve it quickly. In his day the task of feeding troops was simpler than ours. He was only concerned about quantity. And one of his biggest impediments was his source of supply. He had no nationwide industry. His quartermaster bought from the grower, and issued directly to the commands. He did use a long supply line, and a wagon train for transport. But without preserving methods, his food reached his soldiers in a wide variety of conditions—few of them good.

Today's Army faces these problems with far more assurance. This is so because the food producing, preserving and distribution industries do their job so efficiently. The military can acquire its supplies with a minimum effort and confusion. To its everlasting credit, this industrial group, so well represented here this afternoon, has been active in making this true. The country places unspoken reliance in your ability to provide food for its sons and daughters in the armed forces.

The problem of feeding the military forces is brought into sharp relief when one realizes that approximately 35 percent of all the dollars now spent by the Quartermaster Corps goes for food.

A large portion of the success with which we in the QMC have been able to feed the armed forces of the United States stems from the splendid cooperation which your industry has at all times extended to us. Without such cooperation, it literally would be impossible to achieve that level of procurement efficiency which we want to characterize our operation. Obviously, intelligent and realistic procurement of food and food products calls for the utmost of team play between industry on the one hand and the Quartermaster Corps on the other. With a mutual problem to re-

solve, we are anxious to do our part. Let me outline some of the steps which we in the Quartermaster Corps have taken and are taking to make your job easier in helping us to do our job. Briefly there are four steps in our planning this year. These are:

1. The set-aside program.
2. Walsh-Healey Act exemption.
3. Negotiated purchasing using letter contracts initially.
4. A field buying organization.

Let me now go into some of the important elements of these steps.

As you are aware, the Secretary of Agriculture at the request of The Quartermaster General issued a set-aside order in April, 1951. The terms of this order accomplished two goals: canners were given early information as to what would be required of them by the military forces; and, in turn, the military forces received more of their subsistence requirements in preferred can sizes.

Our 1952 requirements, of which more will be said later, are sufficient to justify continuation of Defense Food Order No. 2 to cover the 1952 annual pack. Therefore, The Quartermaster General has made the necessary representations to The Secretary of Agriculture for a set-aside. Although no decision has yet been made, one is expected in the very near future.

Our experience under the Walsh-Healey Act exemption has been highly satisfactory. It was, therefore, clearly indicated this fall that another exemption for the new crop would be necessary. Although we had asked for an exemption covering the full 1952 calendar year, the Secretary of Labor issued one for the period to June 30.

The method by which we can operate to mutual advantage even under the drastically shortened exemption period is, of course, through the medium of letter contracts.

Apparently there has been some confusion as to just what is involved in this type of contracting. The letter contract must demonstrate some value in itself, in order to be a contract. As a contract, it requires the contractor to fulfill its terms, yet paves a way in which both parties can realize a later definite contract based upon actual market conditions. Basically, it enables the canner to do advance planning, and authorizes certain expenditures, such as those for large-size cans and export packing. The amount thus authorized to be spent prior to the execution of the definitive contract will be set forth in the letter contract. Alternatively, it commits the government to absorb any losses incurred by the canner in the event that the army is forced to curtail its requirements, or in the event that we cannot arrive at a price agreeable to both parties. Letter contracts do not—and I repeat do not—commit either party to a fixed price, or anything resembling a fixed price. An estimated price is mentioned in the letter for two purposes only:

1. In order to set a limit on the expenses which the canner may incur and still be reimbursed by the Army, if we don't go through with the contract; and

2. In order to maintain, in our own shop, a record of our total liabilities.

It is our plan to convert letter contracts into definitive contracts on or about the time of starting each pack. If we have to reduce our requirements before entering into a definitive contract, the letter contract forces us to reimburse the canner for his costs up to the amount authorized to be spent.

Col. W. E. PHERIS

As the pack progresses and it becomes time for writing the definitive contract, the price will then be negotiated. Neither the canner nor the Army is bound to *any degree* by the estimated cost in the letter contract. If the market price at the time of such negotiations is lower than the estimated cost, let me assure you that our contracting officers and our buyers will *not* be bound by the old estimate. Nor would they expect *you* to be tied to the estimate if the market *rose* during the interim period. In any event, failure of both parties to conclude a definitive contract forces us to absorb any broker losses you may have incurred. Therefore, your apprehension over the estimated cost and its impact on a future market does not appear wholly valid.

We are willing to make such an arrangement, for it enables us to procure our subsistence in the can sizes we prefer and the type of packaging we require. The importance of these features cannot be overestimated. Let me point this up specifically. Had we been able to obtain our 1951 requirements precisely in accordance with our preferred can sizes and preferred packaging, we would have saved approximately $2,200,000 in added expense, 13 million pounds of sheet steel, 241,000 pounds of pure ingot tin, and 2,217,000 cubic feet of storage space. The saving in shipping space alone would have been the equivalent of 740 freight cars, or 5 liberty ships.

I need not remind you that these are substantial savings. You as taxpayers have a big stake in the economy of our operations. Our interests here are identical—we achieve efficient and intelligent troop support through lesser handling problems. You as taxpayers are protected from waste. You as canners are relieved of unnecessary difficulty in dealing with us.

Therefore, it is evident why we are striving to obtain up to 75 percent of our requirements in No. 10 cans. This, of course, will be reflected in our procurements from here out. Through letter contracts, we both can accomplish this program of savings to our mutual advantage. Knowing the questions that have worried you about this type of contracting, I wish to repeat: letter contracts do not commit you or the Army to the estimated cost set forth in the letter. That figure is merely an estimate used as a basis for identifying our liabilities. It can have no bearing either on the subsequent negotiations for price or even on your pricing pattern for civilian markets. The letter contract is merely a flexible contracting method. It eliminates your being bound to a final price before you have had time to establish your raw costs and related production costs.

Another way in which we can help you help us in our job is to make available our estimated 1952 requirements for annually packed fruits and vegetables. At 3 o'clock this afternoon, these will be officially released here and to the press. These requirements, of course, represent only the best estimates of which we are currently capable. Shifts in our military positions anywhere in the world, for good or bad, may change these requirements. As such situations occur, they will be reflected in our procurements. There is nothing we can do about such changes, but we can mitigate any unfavorable effects on you. Letter contracts are one method of accomplishing this.

We in the Quartermaster Corps are ever mindful that the fine work and intelligent cooperation which the canning industry has evidenced has made easier our task of supplying the armed forces with the food necessary for them to carry out their jobs. I would be remiss in expressing our appreciation for your efforts if I failed to com-

pliment you on the magnificent laboratory you have established at Berkeley, Calif. The armed forces will, of a certainty, benefit greatly from your efforts to push back even further the scientific frontiers still challenging the food processors.

We all look forward confidently to a year of continued close working with the canning industry. Your good efforts are evident. Let me promise you a renewal of our sincere and unflagging determination to cooperate with you in the common aim of efficient procurement.

Estimated QMC Requirements from the 1952 Pack

ARMED FORCES ESTIMATE NEEDS FOR CANNED FRUITS AND VEGETABLES

Tentative requirements of canned fruits and vegetables from the 1952 pack to meet the needs of the Armed Forces were announced by the Department of Defense January 19.

Prepared by the Army Quartermaster Corps, the estimates are subject to modification and are announced to assist industry in planning 1952 production.

Procurement will be effected by the Chicago Quartermaster Depot, 1819 West Pershing Road, Chicago 9, Illinois; and the Oakland Quartermaster Procurement Agency, 124 Grand Avenue, Oakland 12, California. Detailed information on procurement of individual items may be obtained from these two agencies.

The estimated requirements are as follows:

Canned Fruits

Item	Total Pounds
Apples	13,644,000
Applesauce	18,192,000
Apricots	25,723,000
Berries	6,910,000
Cherries, RSP	17,587,000
Cherries, sweet	1,591,000
Figs	4,157,000
Fruit cocktail	13,903,000
Juice, Grape	1,795,000
Juice, Pineapple	9,557,000
Peaches	40,600,000
Pears	14,606,000
Pineapple	28,735,000
Plums	5,023,000
Total	202,023,000

Canned Vegetables

Item	Total Pounds
Asparagus	6,509,000
Beans, Lima	6,859,000
Beans, String	35,267,000
Beets	1,945,000
Carrots	8,452,000
Catsup, Tomato	21,542,000
Corn	53,703,000
Juice, Tomato	30,529,000
Peas, green	46,215,000
Potatoes, sweet	22,592,000
Pumpkin	5,835,000
Puree, vegetable, assorted	701,000
Puree, tomato	2,949,000
Spinach	6,944,000
Tomatoes	49,146,000
Tomato paste	7,073,000
Total	306,261,000

The Canners Are Doing It Again

By S. R. Smith, Director, Fruit and Vegetable Branch, Production and Marketing Administration, USDA

Canners are busy people. They are doing a lot of things, most of which I will not attempt to discuss today, and certainly I will not pass judgment. I do, however, want to be helpful. Helpful in answering questions which I know most of you have and which some of you have been asking.

This is an important time of the year for you folks and you need all the information you can pull together. This is especially so because you are in the process of concluding your plans for finishing one season and laying plans for the start of a new one.

By and large you do a fine job of pointing up your questions. And I am in favor of it. Particularly I am in favor of your asking all the questions you can about the Department of Agriculture's activities as they relate to your business. I want to answer as many of those questions as possible today. Also, somewhere along the line, I want to make one or two observations that aren't just answers to questions.

Now, one question canners ask, under national conditions such as we have today, is what the Department's production goals program in the coming year is going to be. Let me attempt to summarize what answers we have to that question so far.

Within the past few days the Department announced the 1952 production goals for processing vegetables. These goals suggest a slightly smaller acreage than that in 1951—about 2 percent smaller. Taking a swift glance at the crops individually, the Department has requested a 20 percent increase in the acreage of cabbage for kraut, a 5 percent increase in sweet corn and beets, the same plantings as in 1951 for peas, cucumbers, and spinach, and a 10 percent reduction in lima bean acreage. Processing tomatoes we treated as a special case and we requested the same acreage in all states except California. We asked California to reduce its acreage of tomatoes by 20 percent.

In arriving at these goals, commodity by commodity, the Department has eyed carefully the industry stock position, the military requirements, and the potential civilian demand. I realize that the goals which have been set won't be attained automatically. But I feel the record established by this industry in years past will be carried on and that the goals will be met. In order for raw material production efforts to prove most effective, production should be tied into facilities. Consequently, we are again urging growers to assure themselves of an outlet through contracting with processors.

Production from the goal acreage I have cited would be about 15 percent less than that of 1951, if we have average yields. Most of the reduction I mentioned a moment ago would be in processing tomatoes. Although this seems at first glance a rather sharp cut, it really isn't. Last year we had record yields of tomatoes, peas, lima beans, and, in fact, of most of the major vegetables. I have a figure here, and I believe it is a correct figure, that shows 1951 was a year of record production in the nine major vegetables for processing—19 percent above the previous record established in 1946.

Personally—and professionally—I think that's a record in which the industry may well take pride. And I feel that this record is particularly laudable when we consider the troubled times during which the record was established.

I've been asked occasionally whether the Department contemplates setting goals for canned fruits and fruit juices. The answer is "no." The Department hasn't set goals for these commodities in the past and does not intend to set any this year. There are good reasons for this, as you people well know. With these commodities we have more of a problem of working toward efficient utilization of production than one of adjusting plantings to a pack goal. I will say, however, that with average weather conditions we might reasonably expect a canned fruit pack somewhat smaller than the near record pack of last year.

Another question—not so hot as it was a year ago, but still a good question—concerns legal minimums. Legal minimum prices for processing crops are very little changed from those reflected in your present price ceilings on canned products.

The Department is not contemplating a general re-issuance of legal minimum prices for canned fruits, since adjustment factors provided in last year's announcement will, in most cases, give you a satisfactory basis for arriving at your current legal minimums. For vegetables, where the increases were based on the 1950 prices, we do plan to re-issue the legal minimums soon. This is necessary because of revisions in the 1950 farm prices by states, although the revisions in the aggregate are not too significant. However, the series on farm prices on asparagus for processing have been revised substantially. You undoubtedly have noted the breakdown in prices for Illinois and Michigan between snap and cut asparagus. This, I think, provides an an-

swer to at least one of the several questions which were raised in regard to legal minimums for this commodity last year.

From what I hear, most of you seem to be assuming the Department will issue set-aside orders on 1952 packs to assure the Quartermaster Corps of acquiring its needs. It looks to me as though we have a paradox in this instance.

Here we have the canning industry, an industry that has consistently argued against government regulation, urging the Department of Agriculture to impose a government regulation upon it. In a very real sense of appreciation, we consider ourselves highly complimented.

The Department has received requests both from your Association and from the Quartermaster Corps for set-aside orders on canned fruits and vegetables in 1952. Speaking frankly—and I know that when you asked me to come here to discuss things with you it was with the understanding that I would speak frankly—I feel that in view of reduced military requirements and the probable size of the 1952 packs it may be difficult to justify a set-aside order from the supply side. That way of looking at it may be wrong, but I will say the Department is taking a good look at the problem. In any event, you can expect an early definite decision.

There has been surprisingly little criticism of the operation of the set-aside order this past season, but the Department is still reserving judgment on certain phases of the program.

We are interested in how equitably government purchases actually were distributed among the industry and in comparing the individual performance under the order with the quantity covered by the set-aside.

We have heard some complaints about delay in obtaining prompt inspection. Now, while it may not be fully understood by all of you, most of our inspection offices maintain a force of inspectors, actually in excess of their immediate needs, awaiting requests for inspections which, in many instances, have been delayed pending canner and Army field buyer negotiations. Once formal requests and proper clearance from the Army field buyer have been received, delays in inspection have been comparatively few.

I have said there may be some difficulty in justifying a set-aside order this year. However, we will consult further with your industry advisory committee before making our final decision. If we do undertake such an order, I believe that a number of revisions might well warrant serious consideration. These would include provision for automatic release and change in the minimum quantities subject to any order.

One question we in the Department expected to hear more frequently during the last season, and more frequently than we are hearing it now, is: "What about labor?" Very few people have been asking us about harvesting and processing labor, even for 1952. This may be so because a delay in converting industrial facilities to defense production, together with a more efficient interchange of available workers—domestic, foreign, and off-shore—between crops and employers, allowed most areas to complete the harvest season without significant crop losses.

However, it might not be amiss at this time to project our thinking

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about six months into the future. I believe that during this period the stepped up tempo of re-armament production, plus the scheduled speed-up of Selective Service inductions to expand and rotate our armed forces, will exert a powerful leverage on the shrinking supply of manpower available to agriculture. This could result in spot labor shortage problems. And I would strongly advise that you assess immediately the effect of these spot situations on your own individual labor supply situations.

Don't just look at your problems on the basis of national statistics. They may not average out to your satisfaction. Without malice toward anyone, I would remind you at this point of the economist who drowned in a creek that averaged only three feet in depth. He happened to fall in where the water ran nine feet deep. Take a local or community approach to your labor supply problems. While seasonal workers will probably have to be recruited this year from progressively smaller labor reserves, do everything possible to exhaust your community resources before considering other labor supply sources. You may find that close cooperation with the local employment office manager serving your area will turn up many qualified workers who are not ordinarily considered in the resident labor force. Of course, there will be some foreign and off-shore workers available to augment the domestic supply, but this is premium labor and will probably cost you more money. I don't have to tell you that the Department will do everything it can in assisting you to obtain the help needed to do an even greater job this year than you did in 1951.

The discussion of possible labor requirements brings up the problem of other requirements—those for construction equipment, containers, and other materials. Work on these has come a long way since a year ago when I talked with you about the Department's responsibilities as "claimant agency" for the food industry. From first-hand experience, I have learned a lot more about these responsibilities than I knew a year ago, and I'm sure many of you here in this room today have become pretty well acquainted with what we in the Department can and cannot do for you in this field.

But, oddly enough, we are getting practically no questions about the Controlled Materials Plan, or about allocations of materials for processing equipment. While I assume from this lack of questions that everyone is getting along well. I think the question merits at least a few brief comments.

Under the Controlled Materials Plan, the Department of Agriculture is given a quarterly allocation of steel, aluminum, and copper for issuance to construction projects. This is the only program dealing with materials in which the Department makes allocation directly to the individual users. It has handled all the construction applications from fruit and vegetable processors and to date has been able to take care of all reasonable requests for renovation and expansion. The Department has emphasized strongly that it is to the advantage of processors to submit construction applications at least three months in advance of the quarter in which the materials will be required, but as yet we have heard very little from you about building projects for the second quarter. I would remind you at this time that it is getting rather late to take action, particularly if you hope to get on a mill schedule for delivery in the second quarter. By the same token, any applications for the third quarter of this year should, under our published

regulations, be submitted by April 1. In view of the lead times involved in obtaining delivery after an order has been placed, it would be to your advantage to submit your applications even earlier than April 1.

I might point out also that delay in handling construction applications can be avoided if the application form is accompanied by a letter giving complete information concerning the proposed building and the reasons why it is necessary or desirable to build at this time.

Since the allocation of materials for food processing equipment is handled by the appropriate industry division of the National Production Authority, we do not have any direct function to perform and are not in as good a position to appraise the situation. Neither can we estimate equipment requirements as readily as we can estimate tin can requirements. We do know how many tin cans will be required if production goals are reached, but we do not know the amount of equipment needed to supplement present supplies. I don't wish to arouse any needless alarm or worry on your part, but I am seriously concerned about the processing equipment situation.

We in the Department do know that current allocations of material to equipment manufacturers have been cut sharply below the fourth quarter levels. And while manufacturers got less than they asked for last quarter, we have an idea that their allocations were about in line with the level of production in 1949 and 1950. But with the cutback for the first quarter of 1952, it looks as though they might be forced to operate at a level substantially below that of 1949.

I mentioned cans a moment ago. Let me say a little more about them. The limitation order on tin cans has now been in effect exactly one year. Personally, I am very well pleased with the manner in which the order operated during that year. I don't know whether we saved all the tin and the steel we were supposed to save, but I am sure that significant savings were made and that there was at the same time an adequate supply of cans for all major perishable fruits and vegetables. I want to express to the can manufacturers the appreciation of the Department for the job they did. Much of their advance preparation work could not be done in the winter and early spring months and they were compelled to take extreme action, on their own initiative, to cut back limitation items more than required so they could protect the position of the perishable items.

Despite the abnormally low inventory with which they entered the season, there was not, to my knowledge, a single instance of any canner suffering loss of a perishable product because cans were not delivered on time. I think this is remarkable, especially in view of the hand-to-mouth basis on which can companies were operating and in view of the sharp increases in the packs in many areas.

The current uncertainty in the tin situation makes our supply for the 1952 season appear somewhat of a problem. I am inclined nonetheless to be a bit optimistic about the situation, basing my optimism on experience during World War II and also during 1951 when we moved through some very tight situations with respect to cans. I believe that the position of our seasonal pack items will be protected regardless of general developments in this field.

The last question on my list reads something like this when some of you ask it: "How come you fellows changed the signals on granting tax amortization?"

We have handled quite a number of applications for tax amortization during the past year. But there has been a significant change in the policy on tax amortization which went into effect following the moratorium initiated by Charles E. Wilson, the Director of Defense Mobilization, last summer. As you know, our responsibility in this field is limited to making recomendations in line with over-all rules which are laid down by the Defense Production Administration for all claimant agencies.

Until the time of the moratorium, we were told that a facility was entitled to tax amortization if it were essential and there was a shortage of the product regardless of whether or not we believed that it would be useful after the emergency. On this basis, we made favorable recommendations for several standard processing and storage facilities. However, regulations issued since the moratorium stipulate that a facility expected to be useful after the emergency is not entitled to any consideration for tax amortization unless an incentive is required to secure the needed expansion at this time. So there is little, if any, basis for taking favorable action on tax amortization for standard fruit and vegetable processing and storage facilities. Consequently, our activity in this field during recent months has consisted of denying practically all of the applications for tax amortization which we had on hand or which we have rereceived since the moratorium.

Now I don't want to leave you with the impression that I believe canners do nothing but sit around asking questions. That isn't true. If they attempted to do that in this most dynamic and highly competitive industry, they would end up just staying "sot". I want to leave you with the firm understanding that we in the Department realize that you have again done an outstanding production job in the face of many uncertainties. We also want to tell you that your cooperation has been excellent, and we are looking forward to its continuance.

I'll say just one thing more: While you are doing this magnificent job, don't ever be forgetful of quality. You've built your name and your industry on quality, and quantity has followed naturally. Keep it that way.

Canned Food Pricing Regulations

By George L. Mehren, Director, Food and Restaurant Division, OPS

In the spring of 1951, the Office of Price Stabilization consulted widely with members of the canning industry in the preparation of price regulations for 1951 packs. The statute as it stood then required OPS to permit reflection of legal minimum prices to producers; to assure fair and equitable margins to processors; and to interfere with normal production and distribution to the minimum extent required by price control. The industry and OPS agreed that the basic structure of the orders would involve adjustment of some normal base period selling price for changes in raw material costs and in most direct costs of production. It was generally agreed that several types of adjustment provisions would be included in the orders. Since both the industry and OPS agreed upon a 1948 base period—three years removed in time—it was recognized that provision would have to be made for abnormal raw material costs in the base period, abnormal base period ceiling prices, depressed profit situations in the base period and basic changes in methods of doing business. The industry was advised that a general earnings standard offered an avenue of industry appeal. It was also advised that techniques for individual application would be developed as rapidly as possible. In the light of these preliminary discussions, industry representatives and OPS agreed that as much flexibility as possible would be achieved through the process of amendment and adjustment as difficulties appeared in the administration of the regulations.

These basic plans were drastically affected by changes in the statute which occurred during the summer of 1951. The Congressional action, leading to the extension of the Act on June 30, involved a virtual freeze on regulations for a full month. The extension of July 31 again drastically affected the legal basis for OPS operations. A new series of legal minima affecting agricultural products was set out.

The Capehart amendment set out a general anti-rollback provision; a technique whereby OPS could set any prices provided they reflected at least the January-June 1950 selling price plus allowances for all costs up to July 26, 1951; and techniques for individual application to reflect virtually all cost increases with a cut-off date of July 26, 1951. OPS incorporated these difficult and complex provisions into their program as rapidly as possible.

The general performance of OPS in the canned food field can be summarized briefly as follows:

CPR 42 was issued on May 31 as an interim order designed to regulate early vegetables. One amendment was issued and a supplementary regulation to CPR 55 has been formulated in order to simplify pricing of the fall pack of spinach.

CPR 55—the basic vegetable regulation—was issued on July 25. This regulation covers nearly the full field of canned vegetables. Both OPS and the industry agree that it is impossible either for the industry or for OPS to promulgate regulations free of any deficiencies in operation. In consequence seven amendments and eight supplementary regulations to the basic vegetable regulation have been issued. These have provided low-end adjustments as in peas and tomato products; raw material adjustments as in sweet potatoes; optional price procedures as in spinach; seed loss, raw material and other types of adjustments.

CPR 56—the basic fruit regulation—was issued on July 30. As agreed early in the life of OPS, direct profit adjustments were introduced into the regulations affecting three major fruits. Low-end adjustments were made as necessary. Direct Capehart increases in prices were given in such fields as purple plums and olives. Adjustable pricing techniques are exemplified by a supplement covering apple products. In order to repair the inevitable defects of any regulation and to maintain reasonable flexibility in industry operations, some ten amendments and supplements have been issued.

CPR 75, which regulates the soup industry, has been amended only once to provide greater flexibility in base period price definition. The adjustable pricing technique was made applicable to this industry prior to the issuance of the tailored order to assure that supplies would move promptly into commercial channels.

Supplementary Regulation 51 was issued on August 20 to provide a method whereby normal distribution could be achieved in those instances in which the issuance of a tailored regulation was delayed.

Regulations have been issued for canned salmon and canned Maine sardines. As in all other cases amendments were issued as promptly as possible when a need therefor was demonstrated.

In the formulation and administration of these regulations, certain clearly defined operational policies have emerged. The Office of Price Stabilization recognizes that errors may be made in formulating any regulation. It does not apologize for the emergence of technical and other difficulties in the process of pricing. Rather, it stands ready to adjust and amend as necessary. Such adjustments and amendments must, in general, be based upon a proper request of the industry; in all cases they must be supported by adequate data and analysis; adjustments must conform to explicitly stated standards. The Office of Price Stabilization will continuously attempt to facilitate trade flows. We will continue to adjust

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regulations to the statute as it stands now or as it may stand in the future. We shall avail ourselves of the industry counsel and direct participation by industry representatives to the fullest possible extent.

Thus, with reasonable success, OPS was able to cover nearly the whole canned food field. This has involved a large number of commodities in an immensely complex industry. There have been difficulties. They have been relatively few when set against the total coverage of the regulations. Adjustment has been reasonably prompt and, in our judgment, equitable. It is not always true that delay in the achievement of adjustment is entirely attributable to the Office of Price Stabilization.

Plans are now well settled for the formulation of regulations in 1952. While none of us has a vested interest in the continuation of the law, we assume that there will be a price control statute effective on July 1. We assume that the present policy limiting decontrol to luxury items alone will be maintained. We assume that the general policies of the Office of Price Stabilization will not greatly change. We consider that OPS, as before, will conform fully to any amendments of the statute. Finally, we consider that in industries like this one it will not be the general policy of the Office of Price Stabilization to lower ceilings with every lowering in market prices.

With these general considerations covering our plans for 1952, a series of steps has already been taken in preparing the regulations. Five industry consultants have been working on the technical and operational phases of the regulations in order to minimize such difficulties in the future. It appears generally to us that the wisest policy is to maintain the general structure of these regulations. We shall continue to formulate technical amendments and to remedy operational deficiencies as they appear. We prefer to avoid major changes in the structure of the regulations which may lead to new and now unknown inequities or deficiencies.

Completion of 1952 regulations requires the resolution of several issues. We should have advice from the industry at large with respect to the retention of the 1948 base period; with respect to alternative proposals for the pass-through of raw material increases up to the parity level; with respect to the use of 1951 ceilings as a basis for 1952 ceilings; with respect to the retention of low-end and other adjustments which were worked out during the 1951 season.

It appears that some saving in time may be achieved through amplification of surveys and accounting procedures. We expect, therefore, to devote ourselves as soon as possible to reformulating CPR 42—perhaps as a supplement to CPR 55—in order to provide pricing techniques for early vegetables. The mechanical and operational phases of the two basic regulations are now being revised. Upon resolution of the issues still unsettled, a request will be made to USDA for preparation of legal minima dockets and the collection of data will be started.

In summary then, OPS has conformed in full to the general principles discussed with the industry in the spring of 1951. OPS has further conformed to all changes in the statute. While there have been delays and difficulties, basic regulations now cover the entire canned food field. Techniques to minimize both inequities and operational difficulties have been developed with reasonable success. Work has been underway for quite some time on 1952 regulations. The responsibility to develop these regulations is a joint one in which the share of the industry is as great as the burden upon OPS.

CANNING PROBLEMS CONFERENCES

Labeling of Dietetic Canned Foods

By E. J. Cameron,
Washington Laboratory,
National Canners Association

The background of our work on dietetic canned foods and the description of the first part of the experimental program were given fully in a statement presented by Dr. J. R. Esty ("Dietetic Packs in the Nutritional Program", INFORMATION LETTER No. 1325, Feb. 28, 1951) at one of the Canning Problems Conferences of the 1951 Annual Convention. As he pointed out then, this program is part of the industry project on nutrition which was initiated with the joint support of the National Canners Association and the Can Manufacturers Institute in 1941 and which is still actively in progress. Our particular attention to dietetic canned foods began in 1949 and Dr. Esty's remarks pertained principally to the first year's studies.

As one of the important goals in this work, we are attempting to obtain better analytical information for the wide variety of canned foods that would be expected to be used for dietetic purposes. Supplementary to this, we are working to determine the effects of certain technical operations on the sodium content of the final product. To this end, experimental dietetic packs were prepared at commercial operations throughout the country and consideration was given to the effects of certain canning operations on the composition of the foods. For example, particular consideration was given to the effects on sodium content of such operations as gravity separation of peas, brining of apples and lye peeling of such products as cling peaches, beets or potatoes.

Analyses on the first-year samples were conducted by the Wisconsin Alumni Research Foundation and they have been completed. During 1951 there has been a substantial duplication of the first year's sampling program and analytical work is now under way at WARF. It should be completed within a few months.

When this second part of the program has been completed, it is the intention of the N.C.A.-C.M.I. Nutrition Committee to prepare a bulletin on dietetic canned foods to present all the essential data that have been derived, together with comments pertaining to certain canning operations that may affect sodium content. A prominent feature of this bulletin will be discussion of the labeling of dietetic canned foods.

Labeling Situation Confused

It has been apparent to us and to others for the past few years that the labeling of dietetic canned foods has been, to a great extent, a matter of individual decision on the part of a canner or distributor. Basic labeling requirements such as identity of the packer and statement of net weight, are clear, but beyond this there has been little standardization of labeling information to guide the consumer in selection of the product. Many labels are adequate and state the dietary purpose, or purposes, of the product, i.e., low calorie and/or low sodium. They indicate the omission of added sugar and/or salt, and label statements of analysis are provided. Many of these statements are validated from time to time by laboratory analysis of the products.

In some instances, instead of a statement of dietary purpose, a distinctive brand name is supposed to indicate that the product is a dietetic food. Most, but not all, labels carry statements of analysis and in some instances these are obviously quoted from one or another of the few reference books which contain analytical information on canned foods packed without added sugar or salt.

The medical profession, and particularly that part of it interested in diet therapy, has a direct interest in the proper labeling of foods for special dietary use, including canned dietetic foods. This is evident from the requirements as to labeling that are set forth by the Council on Foods of the American Medical Association as the basis for granting the Seal of Acceptance.

Food and Drug Position

We have had several discussions with the Food and Drug Administration on the subject of the labeling of dietetic canned foods and have found dissatisfaction with some of the labeling procedures presently employed. In order to arrive at a better understanding of the problem, a subcommittee of our Nutrition Committee met for discussion with representatives of the Food and Drug Administration. Present at the conference also was Dr. James R. Wilson, Secretary of the Council on Foods of the American Medical Association. Some time later our subcommittee prepared a series of questions which were submitted by letter to the Food and Drug Administration to elicit official opinion in regard to the more important aspects of the problem.

The reply received from the Food and Drug Administration was studied by our Nutrition Committee and was submitted to a number of canners of dietetic foods. Secondary questions arose in the comments of the reviewers and these were discussed verbally with the Food and Drug Administration. Consequently, I have prepared a summary of the original opinions which includes references to questions that have been raised, and also our own interpretations of the problem. The pertinent part of the letter from the Food and Drug Administration is appended to this statement. The summary follows:

1. A "dietetic canned food" is held to be definitely represented as one for special dietary use and therefore subject to labeling requirements pertaining to these foods. The label of the product should bear a statement of the special dietary property, or properties, of the product.

There has been some misunderstanding of what is meant by a "statement of special dietary property." Most, if not all, dietary canned foods would be classed as "low calorie", "low sodium", or "low calorie and low sodium." No reference to specific diseases should be made.

2. If the product is one in which added sugar and/or salt is a customary ingredient, some such statement as "packed without added sugar", or "packed without added salt", would be acceptable. If water is the packing medium a statement such as "packed in water without added sugar" would be preferable. The use of the word "added" is desirable to avoid creating the impression that the product contains no sugar or salt.

3. The label should carry specific information on the amounts of the dietary factors contained in the food that are relevant to the dietary claims. Such information is usually presented in the so-called "statement of analysis." In low-calorie diets values for carbohydrate, protein and fat are important. In low-sodium diets the sodium value is most important.

The canner must assume the responsibility for making an adequate study of his product as a basis for special label claims. Complete reliance should not be placed on published tables of food composition as a basis for specific label statements to cover his products. The canner should make a sufficient number of analyses of his own products to provide data for such claims and he should check new packs periodically to determine whether label changes are necessary. It is believed that as a canner accumulates data in reference to his individual products the necessity for label changes will be infrequent.

The responsibility for accurate labeling extends also to the distribu-

tor who does his merchandising under a private label. Purchases from canners should be checked by the distributor, or from the canner's records, to insure that his label is applicable. Obviously, it would be completely impractical to undertake separate analyses and to prepare special labels for each lot of a canned product. Nor is this necessary where the label statement of analysis is properly based on analytical information and where it carries conservative values, rather than minimums, for the principal factors in fruits and vegetables, namely, carbohydrates and sodium. Some minor variations in values are to be expected and it is presumed that regulatory authorities would not quibble at an analytically determined value of 12 milligrams of sodium as against a label indication of 10 milligrams. But if the product actually contained 30 milligrams of sodium, the label obviously would be incorrect.

4. Label reference to the absence of added sodium (or salt) either on the label or in collateral advertising should be accompanied by a statement of actual sodium content. Best opinion is that the preferable declaration of sodium content is in milligrams of sodium per 100 grams of the food.

For the purpose of illustration, I have prepared a schematic design for a label which carries the information required under the general labeling regulations, together with the special information necessary to comply with the regulations that apply to labeling foods for special dietary use (Figure I).

Low-Sodium Foods

In his address before a Canning Problems Conference at our 1951 Convention, Dr. F. C. Bing (INFORMATION LETTER No. 1325, Feb. 28, 1951) presented a summary statement titled "Nutritional Aspects of Low-Sodium Diets" which should be read and studied by all canners who are interested in the production of dietetic canned foods. In his statement, Dr. Bing described the reasons for sodium limitation in diets and stated in quantitative terms the three levels of restriction that are commonly followed.

No attempt has been made thus far to define a "low-sodium food", and a definition of this kind may be impractical. At present, it seems preferable to consider each product on the basis of the quantity and frequency with which it is consumed.

There is a need for scientific reasonableness in expression of amounts of food factors in the statements of analysis used on labels. False precision is indicated by many of the existing label statements. This point is well developed by Dr. Thurman B. Rice in his new book "Low-Sodium Diet" where he refers to the expression of sodium values. He states:

> "There is no good purpose in attempts to be accurate to a tenth of a milligram. We have in mind an effort which has been made to instruct the layman in these matters which gives menus which appear to be accurate to 0.1 milligram of sodum (0.001 gram, or 1/300,000th of an ounce). This is as absurd as giving distances on a road map in feet and inches instead of miles."

Prospects for Expansion

The possibilities are great in the production of canned dietetic foods and the economy of their use will be a boon to those who require them. A few years ago someone remarked that one had to be well-to-do to live on a restricted diet, which would not be a valid statement now. In 1949 we took a census of canners of dietetic canned foods, and the products packed by them. Our returns showed that there were 17 packers and 33 products. In 1951 we repeated the census and it registered 85 canners and 53 products. The estimated pack of canned dietetic foods for 1951 was 5,000,000 cases.

The findings of a Chicago hospital survey conducted in 1949 has prompted Dr. Bing to estimate the potential market for low-sodium foods to be about equal in volume to the present volume for canned strained and chopped foods. This may be taken as an optimistic prediction, but even if the estimate were altered as a result of a broader survey, it still indicates that producers of legitimate dietetic foods, including canners, have a new opportunity for expansion. But along with the opportunities that are presented, the producers must accept special responsibilities and perhaps liabilities, because among the users of these foods there will be sick people. To extend the confidence presently enjoyed with the consumer and the medical profession, the canning industry will have to assume its particular responsibility in the production of its dietetic products through proper control in production and distribution under regulations that apply to labeling foods for special dietary use.

EXCERPT FROM LETTER RECEIVED FROM FOOD AND DRUG ADMINISTRATION, JULY 6, 1951, CONTAINING QUESTIONS AND ANSWERS CONCERNING THE LABELING OF DIETETIC CANNED FOODS.

General

1. What general labeling requirements should be applied in the case of dietetic canned foods? Should a distinctive wording be required? Should there be specific reference to the fact that such products are for use in restricted diets?

We are of the opinion that a "dietetic canned food" is a definite representation that the article is for special

FIGURE I

Schematic Design for a Label for Dietetic Canned Foods

Brand Name

VIGNETTE

SWEET PEAS

Packed in water without added sugar or salt for special dietary use.

Net Contents 1 lb. 4 ozs.

N. E. Goode Company, Anywhere, U.S.A.

Brand Name

This product has been packed in water without added sugar or salt for special use in low calorie and low sodium diets.

AVERAGE ANALYSIS—PER CENT

Carbohydrates (by difference)	6.8
Protein	3.4
Fat (ether extract)	0.3
Ash	0.4
Crude Fiber	1.0
Moisture	88.1

Calories per 100 grams—43
Calories per ounce—12

Sodium—2 milligrams per 100 grams

dietary use. Paragraph 125.02 of the regulations issued under section 403(j) would therefore require that the label of the article bear a statement of the special dietary property, or properties, of the product. In order to meet this requirement, it seems almost inevitable that the purpose of the product, such as the kind of restricted diet in which it is to be used, would be called for on the label. The nature of the statement would depend upon the particular dietary purpose which the article is intended to serve.

2. How should the absence of added sugar and/or salt be indicated on the label? Should such statements make reference to the presence of water? For example, would the phrase, "Packed Without Added Sugar" be acceptable, or should the statement read "Packed in Water Without Added Sugar"? Is the word "added" necessary or desirable in such terminology?

If the article involved is one in which added sugar and/or salt is a customary ingredient, some such statement as proposed, namely "Packed Without Added Sugar", or "Packed Without Added Salt", would be acceptable. If water is the packing medium, a combination such as suggested, namely "Packed in Water Without Added Sugar" would be preferable. To avoid creating the impression that the article contains no sugar or salt, we believe the word "added" is desirable. This view of course is conditioned upon the assumption that the article involved is suitable for use in diets in which restriction of sugar or the sodium ion is desired.

Label Statement of Sodium Content

1. May the absence of added sodium (or salt) be declared on the label, or in collateral advertising, without subjecting the product to the labeling requirements of statement of amount of sodium contained in the product?

We believe that reference to the absence of added sodium (or salt) either on the label or in collateral advertising requires that the label bear information concerning the actual sodium content of the product.

2. Where a product is offered for low-sodium diets, how should the sodium content be expressed? Would the expression of content as milligrams per 100 grams be acceptable? Would an expression as the range (best available data) and an average be acceptable?

In our opinion, the preferable declaration of sodium content is in terms of milligrams per hundred grams of the food. In some instances where this may not be feasible, a range based upon the best available data, together with an average value, would appear to be the best alternative.

Obviously, frequent examinations of the product for sodium content should be made and appropriate corrections made of any range or average figure given on the label, if the facts require.

3. Since certain products naturally contain relatively high amounts of sodium, should a sodium level be established above which a product would not qualify as a "low-sodium food" even in the absence of added salt? How might a decision be reached in regard to such a level?

We question the desirability of attempting to define a "low-sodium food." It seems to us preferable to consider each product on the basis of the quantity and frequency with which it is consumed and to reach a determination as to whether a reference to its use in a low-sodium diet is justified. We should like, however, to reserve a final opinion on this point until after further study.

Label Statements of Analysis

1. Where a product is offered for use in restricted diets it is understood that the label should carry specific information with reference to the essential dietary factors. What is a satisfactory basis for the label statement of analysis? Should it be permissible to base the statement upon data to be obtained from published tables of food composition, or upon such data after there is assurance that the canner's product would be reasonably represented by such data? Should there be a responsibility upon the canner to maintain a continuous analytical check on the dietary products which he packs?

This question seems to us to be so broad that a specific answer to it is not possible. In undertaking to represent a food as being of value for special dietary purposes, the distributor, in our opinion, must assume the responsibility for making an appropriate study of his product as a basis for special label claims. We do not believe that, generally speaking, complete reliance can be placed on published tables of food composition as a basis for specific label statements. The canner should make a sufficient number of analyses of his own production to provide data for such claims. Variations in raw materials, methods of production, and other factors may easily make a particular firm's product substantially different in composition from the articles examined for the purpose of preparing tables of food composition generally. It is difficult to discuss this particular question in general terms since the specific nutritive factors involved and their normal variations in food products will have a great bearing upon the question.

The Relation of Visible Rot to Mold Counts

By Howard R. Smith,
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The recent official announcement by the Food and Drug Administration of "General Policy or Interpretation With Respect to Comminuted Tomato Products Containing Rotten Tomato Material" (1) makes desirable a review of developments regarding federal control of tomato products.

Few people today can remember the conditions under which tomato products were manufactured by some firms at the time the first Pure Food Law was passed in 1906. It was largely a byproduct industry connected with the canning of tomatoes having little resemblance to our present-day industry.

In the fall of 1908, as a result of a conference between Dr. W. D. Bigelow, then Chief of the Food Division of the Bureau of Chemistry, and B. J. Howard, microscopist, the microscopic examination of tomato products was begun. Many of the commercial samples obtained showed excessive amounts not only of mold but also yeast and bacteria. Further studies by Mr. Howard in canning factories indicated that properly prepared tomato products contained relatively low numbers of microorganisms. The first official statement on this subject was in Bureau of Chemistry Circular No. 68, issued February 13, 1911 (2).

The mold count method was included in this early bulletin and it is significant to note that there has been no change in the basic principles of the method since its first publication. Some improvements to give a greater degree of uniformity have been introduced but the Howard mold count method has been basically the same since its introduction in 1911.

On page 4 of Bulletin 68 the following statement was made: "Investigations under factory conditions clearly indicate that with only reasonable care the proportion of fields having molds can be kept below 25 percent." This statement was more an expression of Mr. Howard's personal opinion than an official pronouncement with respect to limits which might be used for regulatory action.

Notices of Judgment under the Federal Food and Drug Act, June 30, 1906, show that regulatory actions were instituted using the principles of the Howard mold count method as early as 1913. Each year since that time a substantial number of the Notices of Judgment have been based on this test.

The Howard mold count method was introduced to the tomato products in-

dustry by Dr. W. D. Bigelow, at that time Director of Research of the National Canners Association. The first mold counting school was held at the National Canners Association Laboratory at Washington, D. C., in 1915. The results of the next few years' study were reported to the Association of Official Agricultural Chemists by Dr. Bigelow (3).

As the result of several years study the U. S. Department of Agriculture published two bulletins in 1917 on the subject of visible rot and mold count in tomato products, by B. J. Howard and C. H. Stephenson of the Microanalytical Laboratory of the Bureau of Chemistry. The first of these (Bulletin No. 569) (4) is a comprehensive treatise on the steps in the preparation of tomato products and gives definite suggestions for proper handling of the tomatoes. A significant statement in the summary of this Bulletin reads: "The percentage of decay in the sorted stock should be 1 percent or less."

The second Bulletin, No. 581 (5) gives data obtained in a large number of studies of procedures in commercial tomato canning factories. Numerous tables show relation of the character of the raw product to the mold count on the finished product. The following statements are taken from the summary of this Bulletin:

"Field work performed during the past three seasons has proved that with proper equipment and factory management there is no reason for stock ready for the cyclone to contain over 1 percent of decayed material. It was found that of the samples made in the laboratory, none with less than 5.5 percent of rot gave a mold count of more than 50. In the case of factory samples the mold count rises sharply from 0 to 0.5 percent of rot. Beyond 0.5 percent the rate rise gradually decreases until after 20 percent of rot the rate of increase is slow. A mold count of 40 may be obtained in samples having any amount of rot between 2.2 and 100 percent."

In this Bulletin two sets of data are reported. The first set is based on laboratory tests where the tomatoes were taken to the laboratory, the decayed portions were cut out by hand, and weighed, then mixed with the sound tomatoes and the pulp was made by rubbing the material by hand through a 20 mesh sieve. Figure I is a reproduction of Figure I of this Bulletin showing the results of these tests. The Bulletin states that such a pulp is not as satisfactory as a product manufactured commercially because it is difficult to produce in the laboratory a pulp of the same texture as that made under factory conditions. The second set of data is based on tests made in commercial canning factories. As to these, the Bulletin says on page 12: "Under factory conditions it is frequently difficult to trace a definite portion of raw stock through the whole process of manufacture with any certainty that the final product is from the same stock unmixed with other lots. It has, therefore, been considered advisable to average the daily results obtained on the amount of rot and compare them with corresponding daily averages under microscopic tests."

Figure II is a reproduction of Figure II of Bulletin No. 581 which summarizes as daily averages the relation of visible rot to mold count of 179 determinations of visible rot and 235 mold counts in 17 different factories on 39 days.

In both of these charts a "zone" of possible mold counts is indicated by the shaded portion.

In 1916 the Bureau of Chemistry made its first official announcement of a mold count tolerance for tomato products. This first announcement stated that the officials intended to reduce the tolerance just as soon as improved manufacturing conditions permitted. The tolerances have been changed several times and the following table shows the dates and the limits adopted.

TABLE I

Mold Count Limits for Tomato Products

Date	Mold Count Limit	
	Tomato Juice	Other Comminuted Tomato Products
	(*percent*)	
Sept. 5, 1916	..	66
May 14, 1931	..	50
July 1, 1936	35	50
July 27, 1938	25	50
June 17, 1940	15	40
May 13, 1941	20	40

This gradual reduction of the official tolerances enabled the industry to become acquainted with the mold count test and to improve methods of handling tomatoes so that a better product could be produced. Tomato products are produced in many areas of the country and by small canners as well as large establishments. The existence of a definite level of attainment that applied to every canner helped to remove suspicions that certain operators were being unduly penalized. It also permitted the prescribed level to be reached by any or all of several procedures. Some canners placed the emphasis on buying only tomatoes that were practically free from mold. Other canners set up comprehensive sorting and trimming and inspection systems. There was gradual improvement in methods of handling tomatoes and corresponding improvement in the finished products.

When on June 17, 1940, the Food and Drug Administration announced

FIGURE I

Relation between Percentage by Weight of Rot and Mold Count (Laboratory Samples)

BULLETIN 581, U. S. DEPARTMENT OF AGRICULTURE

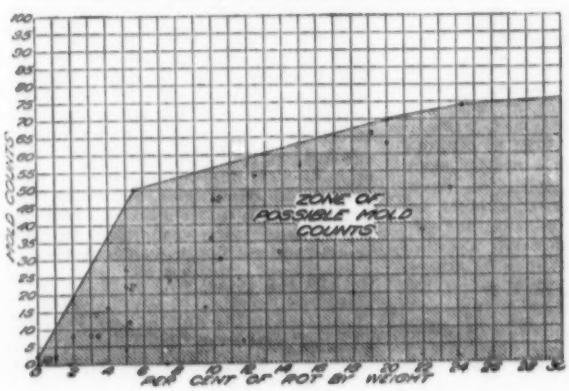
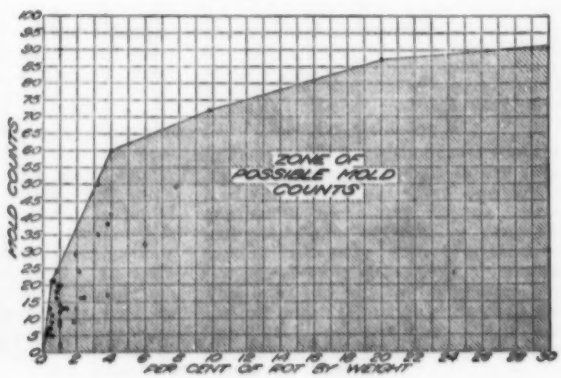


FIGURE II

Relation between Percent by Weight of Rot and Mold Count (Factory Samples)

BULLETIN 581, U. S. DEPARTMENT OF AGRICULTURE



that the tolerance for mold count on tomato juice would be reduced from 25 percent to 15 percent, there was a united protest from industry saying that this was too low a limit and that although a large proportion of the lots of juice produced commercially would have counts below 15 percent, certain lots might be above 15 percent in spite of all precautions which could be taken by the manufacturers. On July 15, 1940, the N.C.A. Washington Laboratory addressed a letter to the Food and Drug Administration petitioning for reconsideration of the announcement because the industry believed that these tolerances could not feasibly be met under conditions likely to occur in normal growing seasons. This communication was joined by all of the regional associations in the principal tomato product growing districts. The tomato products industry also felt that there were additional matters bearing on this subject that should be more fully investigated and to this end the Washington Research Laboratory of the National Canners Association made a comprehensive survey of conditions obtaining in the production of tomato products during the 1940 canning season. The assistance of the research laboratories of two of the major can companies was secured so that it was possible to have all the samples taken by technologists who were familiar with the tomato products industry and were qualified to make accurate observations.

Daily samples, were taken during the 1940 season at each of a group of tomato products factories in each of the three principal Eastern tomato producing districts, namely, Tri-States, New York and Indiana. A pan of at least 50 pounds of the tomatoes after sorting and just before going into the extractors was carefully inspected and the visible rot was cut out by hand and weighed. A sample of the finished product corresponding as closely as possible to the tomatoes examined at the sorting belt was secured. Also, the effect of homogenization on the mold count was studied by getting samples of the juice before and after homogenization.

Figure III shows in graphic form the relation of visible rot to mold count on the 124 samples of unhomogenized juice that were examined.

On April 17, 1941, a complete report of the studies with all of the data was sent to the Food and Drug Administration with a petition that the mold count tolerance on tomato juice be set at 20 instead of 15 percent. The following paragraphs are taken from this report:

"To handle tomatoes commercially so that not more than 0.25 percent of visible rot remains on the tomatoes to be used for manufacture is regarded as a high standard of excellence. Using the figure 0.25 percent of visible rot as a base line from which to discuss the data, there appears to be justification for some reduction in the limit of mold count from the former 25 percent. Only 3 percent of the samples showed more than 25 percent mold count. On the other hand, the data show that the limit of 15 percent is too severe; 20 percent of the samples exceeded the 15 percent mold count limit. Furthermore, the chart shows clearly that there are a large number of other samples that are dangerously close to the 15 percent limit. There are altogether too many samples showing either no visible rot or very small amounts of rot that run 10 or 12 percent mold count. This means that practically perfect sorting will yield samples that are dangerously close to the limit and may at times exceed it in spite of the best manufacturing endeavors.

"The results of this survey suggest forcibly that the mold tolerance on tomato juice at 15 percent is lower than is justified by the necessities of adequate control. A tolerance of 20 percent would, from the data here presented, appear to be equitable and this would permit a satisfactory manufacturing tolerance while still requiring the maximum degree of care in the preparation of the tomatoes for extraction."

Table II shows the effect of homogenization on the mold count. This is in line with general knowledge previously obtained but shows numerically the extent of such increase in the mold count.

TABLE II

Tomato Juice—Effect of Homogenization on Mold Count

Percent by Weight Visible Rot to Extractor	Mold Count	
	Before Homogenization	After Homogenization
0.13	10	10
0	0	8
trace	12	16
0.16	8	6
0	0	26
0	4	31
0.52	4	24
0.05	6	34
0.44	16	26
0.28	18	20
0.14	18	28
0.06	10	12
0.02	10	30
0.12	10	20
trace	10	10
0.26	16	33
0.10	6	14
0.04	10	24
Average 0.13	9.3	20.6

The Food and Drug Administration made additional investigations of its own during the 1940 season and on May 13, 1941, announced that the tolerance on tomato juice would be set at 20 percent instead of 15 percent.

In 1945, a similar survey of tomato products manufacture was carried on by the Washington Research Laboratory of the National Canners Association. The survey was made in six tomato products factories in the East and Middle West areas, the particular purpose being to make observations and obtain data on day-by-day variations in raw tomatoes, the effectiveness of the sorting and trimming operations and the amount of rot in the finished products. In this study 349 samples of raw tomatoes were examined for visible rot and 203 samples of juice were tested for mold count and rot fragment count (6).

The six factories visited varied in size and covered the usual commercial practices in the handling of tomatoes. The amount of visible rot left on the tomatoes was determined by taking a weighed amount (about 50 pounds)

FIGURE III

Relation of Visible Rot to Mold Count

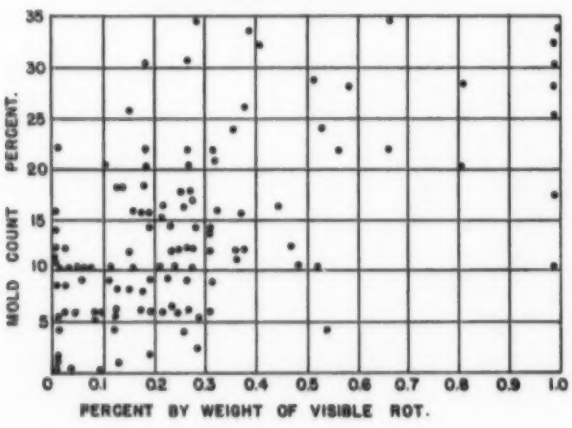


FIGURE IV

Relation of Average Percent by Weight of Visible Rot to Average Mold Count

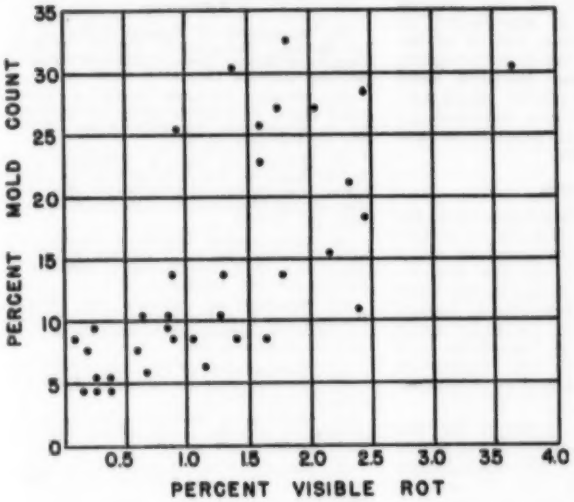
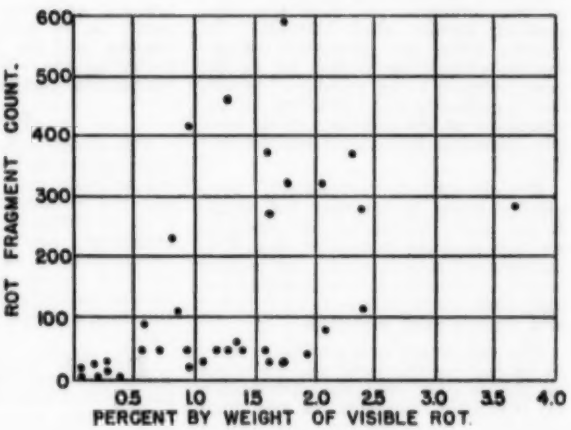


FIGURE V

Relation of Average Percent by Weight of Visible Rot to Average Rot Fragment Count



of the tomatoes at the end of the trimming belt and going over each tomato by hand, cutting out all visible rot, and weighing this rot. These determinations were made as often as possible throughout the day. Samples of the cyclone juice were obtained as nearly as possible at the time the tomatoes represented by the samples would reach the cyclone. Accurate sampling was obviously impossible. It was felt, however, that by taking a series of samples at regular intervals over a considerable period of time—in fact, for several days at each factory—the general relationship between the character of the tomatoes going into the cyclone and the amount of mold in the finished product might be established.

Because of the difficulties of sampling it seemed unwise to associate the results of any individual visible rot determination with the mold count or rot fragment count on a single sample. However, it was thought that the average results of several successive determinations might show a significant relationship. To this end the data were combined to show half-day periods at each factory. These average relationships between percent of visible rot and percent mold count are shown on Figure IV and similar relationships between the average visible rot and the average rot fragment count are shown on Figure V. It will be seen that 1.5 percent visible rot may result in an average mold count of 8 percent or more than 30 percent. Similarly, a mold count of 10 percent may be associated with practically no visible rot or as much as 2.5 percent visible rot. On the other hand, it should be noted that where the average percent of visible rot is less than 1 percent, the average mold count is less than 15 percent in one instance. It should be emphasized that these points are all representative of the average of several samples. In the case of the rot fragment counts shown on Figure V, an average rot fragment count of less than 50 may be associated with as much as 2 percent visible rot. Also, an average amount of visible rot as low as 1 percent may be associated with from less than 50 rot fragments to more than 400 rot fragments. Here again, however, where the amount of visible rot is low, the number of rot fragments is relatively low. It should be noted that the rot fragment method is no longer included in the Methods of Analysis of the A.O.A.C. The method was given in the sixth edition (7) but was deleted by official action of the association (8) and is not given in the current edition of the Methods (9).

Discussion

The results of three separate large-scale investigations of the relationship of visible rot to mold count have been presented. The first of these was the original work by B. J. Howard, reported in the Government Bulletin in 1917. The second was the investigation connected with the proposed reduction in the mold counts for tomato juice in 1940. The third was the investigation of the National Canners Association in 1945. The results of each of these investigations are remarkably consistent. In each case, where the amount of visible rot going into the cyclone was held to a very low limit, the mold counts were also low. When larger amounts of visible mold were allowed to enter the cyclone, the mold counts and rot fragment counts varied greatly. Even average results over a period of time representing the average of a number of determinations do not show exact relationships. Instead of anything approaching a linear relationship, we have on each of the five figures a zone of possible relationships.

Each investigator who studies the problem of the relation of visible rot to mold count is impressed with certain limitations which appear to be inherent and inescapable. The percent by weight of visible rot on tomatoes cannot be determined with precision. The edge of the rotten portion extends into the sound portion of the tomato and the line of demarkation is not definite. Differences between equally conscientious examiners are unavoidable. Also, the character of the rotten portion varies greatly. Some portions of rot are soft and will be completely broken up in the extraction procedure. Others are relatively dense and hard and will be largely discharged with the cores and skins without contributing much mold to the final product. Some pieces of rot are almost entirely mold, whereas others contain very few mold filaments.

The proportion of tomatoes containing rot may vary greatly in the same load and especially from one lot to another. Such lots become mixed and the tomatoes passing over the sorting belt show great variation in the proportion that need trimming. The efficiency of the trimming and sorting may vary greatly on the same line within a short time. Any circumstance which permits the atten-

tion of the sorters and trimmers to become lax or diverted will contribute to this variation in the efficiency of sorting operation. It is, therefore, almost impossible to take a sample of the tomatoes from the end of the sorting belt which can be considered to represent the average or general run of the tomatoes put into the final product during that interval. Of course, when the proportion of tomatoes containing visible rot in the raw tomatoes being purchased is low, the opportunity for variations in the character of the tomatoes going over the trimming belt is correspondingly low.

Occasionally — fortunately, very rarely—there is internal rot which is not easily visible on the tomatoes as they pass the inspection belt. One instance of this occurred last season and for a time it was necessary to cut open each tomato in order to detect and remove such material.

The equipment and procedure used in extracting the juice has an effect on the number and the distribution of the mold filaments in the final product. Investigators are agreed that samples prepared in the laboratory do not correspond with commercially-prepared lots and that all investigations purporting to have a bearing on commercially-prepared products should be based on experiments carried on with commercial equipment. An extreme example of the variations that may be so caused is that resulting from homogenization.

Much has been said and written about the difficulties of the Howard mold count method itself as an analytical procedure. That the method does have limitations is well recognized today. These limitations are quite clearly understood and are taken into consideration in the interpretation of the results. Many kinds of molds occur on tomatoes as grown commercially for manufacture. Fortunately, in making official mold counts, no attempt is made to differentiate between types of mold which may be present. The method, as originally proposed by Mr. Howard and as used practically ever since, is based on common characteristics of the filaments which are to be classified as mold. These have been described in the Government Bulletin on this subject (6) and are used by those who are familiar with the method (10). Each analyst must receive personal instruction in the method before he is qualified to make official counts. However, means are available for giving such instruction to all of those who have occasion to make counts. By following the official procedure in every detail, it is possible for properly qualified analysts to obtain satisfactory checks on the same sample. Within the past year there was occasion for eight analysts representing three organizations to check mold counts. It was found that there was no significant difference in their counting. The nature of the product being tested and the limitations of the method itself make absolute agreement on all samples impossible, but it is believed that in the hands of properly trained analysts the Howard mold count is a satisfactory analytical method and the results obtained by following the official procedures are reasonably consistent.

Conclusion

The results of three separate investigations of the relation of visible rot to mold count in tomatoes show (1) the presence of only low proportions of visible rot results in low mold counts and (2) the presence of higher proportions of visible rot may result in high counts or in relatively low counts depending on the nature of the mold and the method of manufacture.

The recent announcement by the Food and Drug Administration states clearly that they will still regard high mold counts as indicative of unsatisfactory condition of the raw material used with respect to the presence of filth. On the other hand, low mold counts are not necessarily conclusive evidence that proper care has been used in the removal of all types of objectionable rot. The emphasis is to be placed on the appearance of the tomatoes being put into the final product. To this extent, mold counts may come to be regarded as of secondary or, at most, coordinate importance.

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Observations and Suggestions on Factory Control of Rot and Extraneous Matter in Tomato Products

By M. V. Eisenberg,
Food and Drug Administration,
Federal Security Agency

I would like to discuss some of the highlights of the Food and Drug Administration's laboratory and inspectional activities in the tomato products field as they affect factory control of extraneous matter in tomato products. The two most important types of extraneous matter or contaminants from the standpoint of frequency of occurrence are (1) decomposed tomato material from improperly sorted and trimmed tomatoes and from slime accumulations on unclean equipment and (2) fly eggs and maggots from fly-infested raw stock or from a fly-infested factory.

The Howard mold count method and other microscopic methods such as those used for the detection of rot fragments and machinery slime, all of which are based on mold filaments as the diagnostic character, are available for judging the finished product with respect to the presence of decomposed tomato material. The Administration relies also on factory inspections as a means of enforcing the Federal Food, Drug, and Cosmetic Act. The inspector takes scrapings of any slimy accumulations and makes a thorough examination of equipment to judge proper cleaning. He examines the sorted and trimmed stock to judge the effectiveness of this operation in eliminating rotten tomatoes.

For years, these laboratory and inspectional techniques have been used by the Administration. They supplement each other and give a complete picture of a factory's operations, thus enabling the Administration to judge each case on its merits. This, as you will appreciate, is frequently quite desirable in view of the many factors involved in problems concerning mold and decomposed material.

What are some of these factors? The late B. J. Howard in his pioneering work published in 1917, entitled "Microscopical Studies on Tomato Products" (1) expressed the general situation surrounding this problem. He said, "A low mold count does not necessarily indicate sound stock, but a high mold count always indicates bad stock or improper handling." Improper handling refers to slimy tomato accumulations on unclean equipment.

Figure I taken from his work shows the relationship between the percentage of cut-out rot and the mold count on factory samples of tomato pulp. Mr. Howard connected the points on the graph which showed minimum amounts of rot for a given mold count and obtained a zone or range of possible mold counts corresponding to a given amount of rot. It was apparent that there would not be an equal contribution of mold filaments from the various types and sources of rot in proportion to the amounts of unfit material. On an objective basis, therefore, Mr. Howard correlated the mold count with the minimum amount of rot present as designated by the solid line connecting the outer points on the graph.

What is the significance of Figure I from an enforcement standpoint? Mr. Howard realized that it was inevitable that in many cases involving poor sorting and trimming, or other objectionable conditions contributing rot, finished tomato products with mold counts of less than 25 percent would result. This is the mold count figure which he considered, as early as 1917, could easily be met by good manufacturing practice. On this basis, examination of the graph shows that in 7 out of 39 daily operations sampled, or approximately 18 percent, the mold count was appreciably lower than 25 percent although the operations were not conducted under good factory practice because more than 1 percent cut-out rot was present.

It is obvious that certain limitations surround the use of the mold count method. Since the method is based on the recognition of mold filaments in a comminuted, processed product, rots which are caused by bacteria, viruses, and physiological causes, unaccompanied by mold, are not detected by means of the method. In addition, different types of mold exert different effects on the mold count. A study was conducted by the microanalytical laboratory on different types of tomato rot selected from tomato fields and growers' deliveries to canning plants in Indiana. The results of this study are shown in Table I.

The problem illustrated by the above studies is one that has been brought home to our inspectors in many of their tomato factory inspections. Instances have arisen where large amounts of rotten tomatoes are getting by the sorting and trimming operations. On being advised of this situation by the inspector, some plant managers have sought to excuse such operation by claiming that their mold counts are not excessive. It cannot be too strongly emphasized that control of this problem should be concerned primarily with actual factory operations themselves. The mold count should be considered only as a check on the proper selection and sorting of raw materials in the factory. The primary control of rot should be exercised by supervision of packing opera-

FIGURE I

Relation between Percentage by Weight of Rot and Mold Count (Factory Samples)—Broken Line Added

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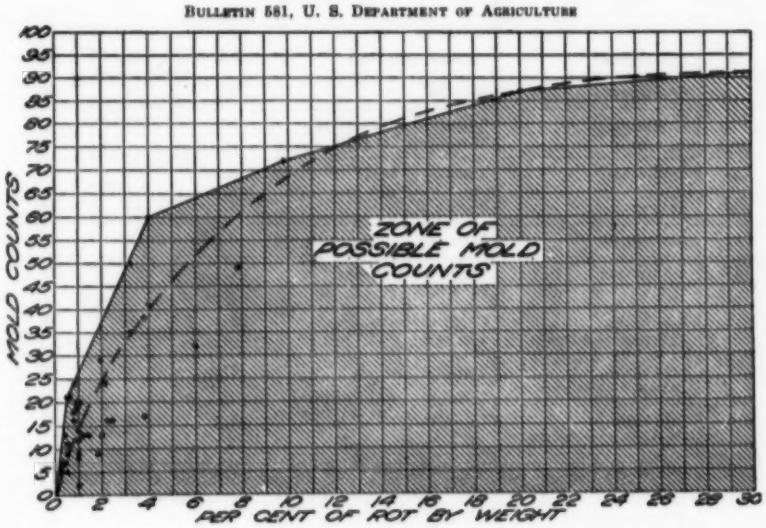

TABLE I

Mold Counts of Juice and Puree Prepared in Laboratory from Tomatoes with Different Types of Rot

Expt.	Type of rot	Diameter of rot on tomato	Percentage of cut-out rot, by weight	Percent of mold count	
				Cyclone juice	Puree
4	*Alternaria*, in growth crack	ca. ¼ of tomato surface	2.7	53	56
6	*Alternaria*, on sunscald area	1¼"	2.5	39	54
12	*Alternaria*, on sunscald area	3 tomatoes, 1 spot on each— (1) 2" x 2" (2) 2" x 1½" (3) 1½" x 1¼"	6.9	94	....
32	*Alternaria*, on sunscald area	2 tomatoes— (1) 2½" x 2½" (2) 1" x 1¼"	10.1	79	96
7	Completely decomposed, soft, sour, with *Alternaria*	Completely rotten	100.0	25	40
34	Soft, watery brown rot, with *Alternaria*, yeast, and bacteria	2½" x 3"	32.8	99	97
28	Blossom-end soft rot, with *Alternaria*, *Fusarium*, yeast, and bacteria	1½"	11.1	80	79
29	Gray-black rot, probably *Alternaria*	Sunken spots up to ⅜"	2.7	44	52
22	Smooth, black rot, species of *Alternaria*	6 tomatoes, 1 spot on each, ¾" to 1¼"	3.1	61	71
8	Anthracnose	4 spots, each ¼"	0.3	0	1
9	Anthracnose	½" x 7/16"	0.4	5	5

Expt.	Type of rot	Diameter of rot on tomato	Percentage of cut-out rot, by weight	Percent of mold count	
				Cyclone juice	Puree
10	Anthracnose	10 spots, 1/16" to 1"	7.0	92	100
11	Anthracnose	1/8" x 3/8"	0.6	18	27
23	Anthracnose	5 tomatoes with total of 42 spots, 1/4" to 1 3/8"	5.1	43	47
35	Anthracnose	5 spots, 1/4" to 3/4"	5.9	57	64
40	Anthracnose	5 spots, 1/4" to 3/4"	3.1	55	54
41	Anthracnose	3/4" x 3/8"	0.6	13	30
43	Anthracnose	2 spots run together, 1/8" x 3/4"	1.1	20	38
1	Late blight, *Phytophthora infestans*	Ca. 1/4 of tomato surface, 4 spots, 1", 1", 1", and 2"	23.5	28	48
2	Late blight, *Phytophthora infestans*	2 spots, 1" and 1 1/4"	7.3	21	26
3	Late blight, *Phytophthora infestans*	2 1/2" x 2 1/4"	46.0	98	100
21	Late blight, *Phytophthora infestans*	6 tomatoes with 1 or 2 spots each, 1 3/8" to 4 1/2"	17.1	24	36
5	White crack mold (*Oospora sp.*)	Crack 2" long	1.0	55	54
31	White crack mold, sour (*Oospora sp.*)	Crack 2" long, rot extends 1 1/2" across crack	9.0	60	78
24	White crack mold, sour (*Oospora sp.*)	.....	18.0	62	76
42	White crack mold, sour (*Oospora sp.*)	Crack 4" long, rot extends 1 1/2" across crack	14.6	89	91
17	White crack mold, slightly sour (*Oospora sp.*)	Crack 2 1/4" long, 1" x 2" softening	10.0	100	100
30	Soft brown soil rot (with *Oospora* and bacteria)	3 spots, 3/4", 3/4" and 1 1/4"	10.4	84	90

tions. A high mold count is a post-mortem observation of conditions in the plant contributing rot. This brings us to a consideration of actual plant conditions themselves and means of control to exclude rot. The two factors involved in factory control of rot of utmost importance are (1) control of raw stock and (2) an effective sorting and trimming system geared to the type of raw stock being handled.

Control of Raw Stock

The type of raw stock being handled is probably the most important consideration facing the quality control man. If the raw stock is good seemingly any system of sorting and trimming may appear efficient. It is obvious that the test of a plant's sorting and trimming system will arise mainly when the raw stock contains a large percentage of tomatoes requiring sorting and trimming. The important question facing factory management at such a time is whether the factory's sorting and trimming system is geared to handle such stock. This is an individual problem and will vary among different plants. The decision to accept raw stock requiring considerable trimming should be governed by the plant's ability to adjust operations to handle such stock. The cost factor is an important element in this decision. The use of federal-state grading in the purchase of tomatoes is helpful in control of raw stock. A premium price for high quality tomatoes and a penalty for delivering culls should encourage growers to deliver good stock to the plant. It is to the canner's advantage to be aware at all times of the type of raw stock that is being run.

Sorting and Trimming

Most sorting systems generally are modifications of either the single belt or the divided belt sorting table. Either system is capable of doing a good job if properly used.

The divided belt system has a great deal of merit when the stock requires considerable attention. It can be used in a flexible manner and can be readily adjusted to the raw stock being run. With the belt divided into three lanes and the washed tomatoes feeding to the two outer lanes, only totally sound and trimmed tomatoes are placed in the center lane. In this manner all tomatoes are handled by either the sorters or trimmers. The sorters at the head of the belt move all perfectly sound tomatoes into the center lane. The tomatoes remaining in the two outside lanes pass to the trimmers. By this method only good tomatoes can go through unless bad material is carelessly thrown into the center lane. A final inspection at the end of the center lane can guard against this. Although this system requires more handling of the tomatoes than the single belt, such extra effort is well expended when a large proportion of the fruit requires trimming. If a glut of bad tomatoes confronts the sorters and trimmers so that they cannot keep up with them, the partly rotten tomatoes do not go into the product. The divided belt is easily integrated into setting up the sorting and trimming as two separate operations. Attempts to combine sorting and trimming can result in poor sorting and poor trimming.

The single belt system can also be employed effectively. One of the most common errors in the use of this system is the employment of extremely long belts instead of more and shorter ones. There is an economy of handling and less rough treatment with shorter belts as well as better opportunity for sorting and trimming. There is also more opportunity to deploy some of the belts to handle raw stock requiring special care.

One type of sorting and trimming operation which has probably resulted in more trouble than any other is one in which a single belt is used for the preparation of canned tomatoes with the residual tomatoes being used for a comminuted product. Too frequently in such operation, sorting and trimming is performed on scalded tomatoes and unfit skins and cores from canning are used. Sorting of scalded tomatoes is particularly difficult because the scalding obscures the rot. Sorting and trimming to remove rot in such operation should be done before scalding. If skins and cores are to be used, the peelers must be made to realize that all decayed portions should be eliminated. This dual function of the peelers may make this practice unsuitable with many types of raw stock.

Fly Infestation—A Factory Control Problem

Tomato packers are well aware of the hazards to their products arising from fly-infested stock or fly-infested premises. Again it is well to emphasize that control of factory operations is the primary safeguard for production of wholesome products rather than a test on the finished product.

In the manufacture of strained tomato products, the cyclones, finishers and other equipment disintegrate many of the fly eggs and maggots. Maggots over 2 mm in length seldom survive the process to be recoverable

as such from the finished product. Experiments have shown that less than half of the eggs and small larvae will go through the cyclone and finisher screens. Homogenization disintegrates all eggs and larvae. A sample of juice showing 60 eggs per 100 grams by the microscopic method showed none after homogenization at a pressure of 2,000 pounds per square inch. This serves to emphasize that the objective examination may not reveal the full extent of the fly infestation. The complete picture and significance of the objective findings are frequently revealed only by observations of the raw material and conditions under which it is held and processed.

Aim your control of fly infestation at factory operations rather than a test of the finished product. Test the raw stock for fly infestation; check the dry sorting and washing to see if soft rots and cracked tomatoes that may harbor eggs and maggots are eliminated or trimmed; examine the premises frequently for accumulations of refuse and spillings which may serve as possible breeding grounds for flies; and test equipment for accumulation of slime which is especially attractive to vinegar flies.

Factory control of fly infestation is an old story. Most packers are familiar with the black-bottom pan method for fly eggs and maggots. Effective measures of control can be summed up briefly.

1. Accept only good raw stock.
2. Handle stock promptly.
3. Wash stock thoroughly with frequent changes of water.
4. Sort and trim effectively to remove soft and sour rots and badly cracked tomatoes.
5. Keep premises clean; dispose of waste promptly. Accumulations of souring juice and tomato material in floor drains, on the under side of peeling tables, conveyors, and other equipment may serve as breeding grounds unless they are washed daily. Ditches filled with decaying tomato material near the plant may produce enormous numbers of flies. The refuse lagoon, if at all necessary, should be as far from the plant as possible and fly breeding in such a place should be controlled. Flies in the plant should be controlled by frequent spraying when the plant is not in operation.

There has been real progress in the processing of tomato products since Mr. Howard's pioneer report in 1917 and most manufacturers can, and do, produce finished products substantially free from rot or extraneous matter. With practical methods of factory control readily available to all, there is little excuse for the packing of adulterated products.

References

(1) "Microscopical Studies on Tomato Products", U. S. Department of Agriculture *Bulletin 681*, October 6, 1917

(2) "Notice to Tomato Canners", U. S. Food and Drug Administration, January 6, 1934

Expt.	Type of rot	Diameter of rot on tomato	Percentage of cut-out rot, by weight	Percent of mold count	
				Cyclone juice	Puree
16	Soft, sour (with *Oospora*, yeast, bacteria)	.....	12.5	94	100
36	Black stem-end rot (with *Oospora*)	1⅜"	16.8	100	100
27	Blossom-end soft rot, unidentified as to organism	1¼"	5.4	48	52
20	Blistery rot	3 tomatoes, 1 spot each— (1) 1¾" (2) 1⅜" (3) 1" x 1⅜"	19.0	86	99
25	Brown, smooth, blistery, gassy, sour rot, containing bacteria	1¼"	36.6	23	36
37	Catface	No visible rot	0	3	2
39	Gray-black rot, unidentified as to organism	3 spots ca. ⅛" 6 spots ca. ¼"	1.1	1	2
44	Gray pustule-like scab	7 scabs all less than ¼"	....	1	1
20A	Growth cracks	Radial and concentric cracks, slight softening of tissue along one crack	....	1	4
26	Growth cracks and possible nailhead	13 tomatoes, 6 with rot less than ⅛", 1 with rot ⅛"–1"	1.5	35	34
13	Soft, brown soil rot, unidentified as to organism	2⅜"	29.7	100	100
14	Soft, brown soil rot, unidentified as to organism	1-7/16" x 1⅜"	6.9	80	91
15	Soft, brown soil rot, unidentified as to organism	2"	12.9	91	98

Influence of Post-Cooling Operations on Spoilage by Recontamination

By O. G. Braun and W. L. Pletcher, American Can Company

At the Canning Problems Conference held during the 1937 convention of the National Canners Association, G. C. Scott (1) reported the results of a detailed study of chlorination of cooling water and pointed toward the importance of the use of cooling water of low bacterial count as an aid in minimizing spoilage losses. In the past 15 years, these principles discussed by Mr. Scott have become widely accepted in the industry and the necessity of the use of cooling water of high sanitary standards has become an established fact. (2) At the 1946 Canning Problems Conference, C. L. Smith (3) discussed "The Relationship of Spoilage to Rough Handling and Contaminated Cooling Water" and showed how the condition of the can doubleseams together with poor operation or poor adaptation of automatic filled can handling equipment in the presence of contaminated cooling water has led to persistent losses by canners through spoilage resulting from recontamination.

During the past five or six years, however, serious outbreaks of spoilage have occurred in products handled over automatic handling equipment where the cans had been cooled in water of unquestionable bacteriological condition and where no manufacturing or closure defects were apparent to which leakage could be attributed. Bacteriological inspection of the exteriors of the cans, however, revealed high concentrations of spoilage organisms around the outside of the doubleseams and surveys of the filled can handling lines disclosed serious focal points of infection which

could inoculate the seams of the cans with large numbers of organisms. When filled cans are handled in automatic equipment, elevators and runways, frequently at high speeds, small deformations of the seams may occur which momentarily break the seal at that point. The larger size cans are more subject to this seam denting because of the momentum imparted by the weight of their contents. Often even well-designed, properly adjusted equipment may cause almost imperceptible flat dents on the seams of these heavy cans. Controlled laboratory tests have shown that even this type of dent can cause momentary leakage and if spoilage bacteria are present, some may be drawn through the seam at that time.

One of the first focal points of contamination to be recognized in filled can lines were felt moisture-absorbing pads on steam hot-plate dryers into which the doubleseams of the cans were pressed by a top belt. In one instance, continued spoilage in 404 x 700 cans of tomato juice disappeared when a narrower pad which did not contact the can seams was substituted for the regular equipment. In order to evaluate the importance of possible contamination from the wide type of pad as well as to check other changes in the handling line made during the spoilage period, 4,000 cases of the product were packed without any pad in the dryer and subsequently 4,000 additional cans were packed and passed over a felt drying pad which had been inoculated with organisms derived from spoiled tomato juice and grown in tomato juice serum. The spoilage rate encountered under the conditions of the test was increased 36 times by the introduction of the inoculated drying pad.

During the past season, an inspection was made of 25 404x700 tomato juice plants throughout the country with particular reference to the filled can handling practices. Qualitative or semi-quantitative bacteriological surveys were conducted in nine of these plants located in the Middle West. Attention was directed chiefly to the lines following the cooling equipment. While bacteriological procedures for the examination of water are well established, no reliable quantitative methods were available for evaluation of the sanitary condition of belt conveyors, steel runways, etc. On this equipment, sterile cotton was used to swab off the material under observation and the swabs shaken with 10 ml portions of sterile water with subsequent serial dilutions poured on orange serum agar plates. Similar swabbing techniques were used to examine the condition of the cans around the doubleseam area.

In these surveys, all types of equipment following the cooler were invariably found to be contaminated. Typical data obtained are shown in Table I. It should be emphasized in presenting any specific bacterial counts such as these, however, that many variables interfere with the samplings. The amount of moisture on the equipment, the grease and dirt present, the accessability of the part, the speed of operation and the interval of time between the passing of cans over the equipment, all complicate the sampling procedure. In presenting the data, therefore, one cannot specify so many bacteria present per unit area or per can but instead one must consider the counts in relation to others obtained as being high or low, as representing good practice or as presenting definite spoilage hazards.

It was surprising to find that the conveyors taking the cans away from the cooling tanks were in most cases severely contaminated even though few organisms could be recovered from the cooling water. Any porous material contacting the cans, particularly in the doubleseam area following cooling must be looked upon with suspicion. Frayed belt retarders used to arrest the cans have been found to be seriously contaminated. In one instance, persistent spoilage in 404 x 700 cans of tomato juice was eliminated by removal of a piece of badly worn and highly contaminated belting which served to cushion the cans in a sliding drop chute. Water dripping off this pad was found to harbor in excess of 300,000 organisms per ml despite the fact that it was placed in the line approximately 25 feet behind the cooling tank from which no growth was obtained when portions of the water were plated either in dextrose tryptone agar or in tomato serum agar.

The use of cooling water of questionable character, of course, aggravates the bacterial condition along the runways on which the cans are subsequently carried. In one fruit juice plant where spoilage was being encountered, water at the discharge end of the cooling tank harbored a bacterial population capable of growing in acid media of 800 organisms per ml. Water running off of an elevator belt carrying the cans from the tank was found to have a plate count of 2,400,000 organisms per ml and the belt and conveyor tracks were covered with a slime growth of spoilage organisms. The coating of slime on the belt conveyor was removed by thorough scrubbing with a stiff brush and detergent, and the reappearance of the growth was effectively prevented by chlorination of the cooling water in accordance with accepted practices. However, two days after this cleanup and chlorination procedure was instituted, the rubberized canvas elevator belt was still found to be a source of contamination. Rinsing of the container doubleseams with sterile water showed a bacterial count of practically zero as the cans emerged from the cooling tank, while 1,200 spoilage organisms per ml of rinse water were recovered from the doubleseam area of duplicate cans collected at the discharge end of the short elevator belt. In view of the difficulty of sterilizing belts of this type, from which the rubberized coating has been partly worn off, it is advisable to discard the contaminated belting and replace with new material having a non-porous surface.

In addition to the rather obvious hazards introduced by porous materials contacting the filled cans in the line, solid steel runways and can chutes in which the cans roll may collect dust and debris. In the presence of moisture carried by the cans, this equipment can harbor spoilage organisms which collect in and around the doubleseams of the cans. In one particular plant packing No. 10 cans recently surveyed, swabs taken on the runways in and following the labeler ranged from 12,000 to 500,000 organisms per section approximating one square inch in area. Small but persistent amounts of spoilage were eliminated after steps were taken not to convey the recently cooled, wet cans over this equipment.

It is generally recognized that the top doubleseam which is formed under adverse conditions of heat and moisture in the canning plant is somewhat more subject to leakage at points of abuse than the bottom doubleseam which can be formed under more carefully controlled conditions in the can factory. Thus, particular care must be exercised to avoid contamination in and around the top or packer's doubleseam immediately after the cooling period before the compound is "set" or before it resumes its normal plasticity. This is illustrated by one outbreak of spoilage in a plant where the cans were carried top end down on a long cable runway from the cooler to the labeling machine. The losses resulting from recontamination in the filled can handling line (combined with the usual handling in labeling and casing) were completely eliminated by carrying the cans bottom

TABLE I

Runway Contamination

Station	Plant A	Plant B	Plant C	Plant D
Cooling Water (org./ml.)..	0–540	1–10	35–480	0–3
Runway from cooler*	25,000–>300,000			
Belt Conveyor from Cooler*		2,000–6,000	10–300,000	>300,000
Warehouse runway*			>300,000	25,000–>300,000
Approach to labeler*	60,000	104,000–>300,000	160,000–>300,000	2,700–220,000

* Total count per swab covering approximately 6 square inches.

end down on the cable runway. By this expedient, the contamination which collected in the water on the bodies of the cans as they passed through the warehouse area ran down around the bottom seams rather than the top seams. The seams carried uppermost on the cable were practically dry at the labeling machine. In this instance, the cooling water was not chlorinated but was not grossly contaminated. Its bacterial count ranged from 60 to 800 organisms per ml. Water dripping off the line near the labeler, however, revealed counts of 31,000 to 90,000 organisms per ml including typical gas forming spoilage organisms. Spoilage of the rate of 5 cans per thousand checked in a 5,800 can run was cut to zero in the subsequent 5,800 cans run after the position of the cans on the cable runway had been changed as a temporary expedient.

The sanitary condition of the can handling lines and the resultant contamination transferred to the cans is related directly to the amount of moisture present in which the spoilage organisms are suspended and can grow. In continuously operated lines, efficient can dryers placed in the system soon after the cooler are, therefore, effective in controlling line contamination. The effects of rough handling in labeling and casing are considerably minimized when the cans are perfectly dry at that point. Tunnel dryers in which the cans are carried upright through a current of warm air are not very efficient. More complete removal of the water from around the seams is accomplished in tunnel dryers through which the cans roll over a steam heated plate. High velocity air jets which blow the excess water from the cans as they emerge from the cooler have also been found to be effective in drying the cans in continuously operated lines. In noncontinuous lines, the advantage of allowing cans to dry in the retort crates before discharging with automatic can handling systems has been pointed out by Smith. (3)

Unfortunately the spoilage hazard from recontamination of the cans in the filled can handling equipment has not been widely recognized. In addition, because of the fact that much of this equipment is situated in the warehouse and not readily accessible to the regular daily clean-up crew, systematic periodic cleaning of this equipment is not commonly undertaken. It has been demonstrated that significant build-up of spoilage organisms collects on the conveyor belts and runways wet with cooling water even though water of good sanitary condition is employed in the cooler. Consequently, it appears highly desirable that more attention be given to sanitizing these portions of the lines regularly in order to hold contamination to a minimum. All tracks, belts and bars which come in contact with the cans should be scrubbed thoroughly to remove extraneous materials. These substances are often gummy or caked on the equipment and are not removed by simple flushing. The entire line, therefore, should be scrubbed with a stiff brush using a detergent prepared in the concentration recommended by the manufacturer. After scrubbing and a subsequent rinse, a germicidal solution should be applied freely to all belt elevators and conveyors at the time of each plant clean-up.

Summary

It has been shown that contamination of filled can handling equipment directly contributes to spoilage losses despite the use of cooling water of good sanitary condition. Control of spoilage through reduction of line contamination is effected by drying the cans as rapidly as possible after cooling, by elimination of porous materials contacting the cans, and by regular sanitization of the equipment used in conveying and handling the filled cans.

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(1) G. C. Scott, "Importance of Cooling Tank Contamination." *The Canner 84*, No. 12, Part 2, p. 99, Feb. 27, 1937.

(2) E. J. Cameron, "Advantages and Disadvantages of Chlorination of Cooling Water." *Canning Trade 61*, No. 28, p. 58, Feb. 13, 1939.

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Vacuum in Canned Foods—Its Significance and its Measurement

By J. M. Boyd and J. H. Bock, Continental Can Company

Introduction

The term vacuum strictly speaking is a space devoid of all matter—in other words, a container full of nothing. In the canning industry the term is commonly used to denote the extent to which air has been eliminated from a can. Actually, the term vacuum, as used in the canning industry, is only a measurement of the difference between atmospheric pressure and a lower pressure existing in the closed container.

When the art of canning was first introduced, no knowledge of bacteriology existed. The first canners were of the opinion that vacuum in some way was responsible for preservation. Consequently, the techniques employed were such as to result in a high vacuum in the canned food. A little later the theory was advanced that the elimination of oxygen from the can was responsible for preservation. Since the establishment of a vacuum is one way of minimizing oxygen content, canners have strived to obtain a maximum vacuum. With the development of a knowledge of bacteriology and bacterial spoilage it became obvious that not the vacuum but the heat destruction of the bacteria present was responsible for preservation. However, the idea that vacuum is necessary to prevent bacterial spoilage still persists.

During the past decade commercial canning has experienced some revolutionary changes in canning techniques. The exhaust box is giving way to methods of mechanical vacuum and steam flow closure. These methods inherently require frequent checking to assure satisfactory performance. This has tended to enhance rather than dissipate the idea that vaccum in some way contributes to the preservation of canned foods. For this reason it was felt that a thorough discussion of the significance of vacuum in canned foods and the measurement of vacuum would be desirable in order to eliminate some misconceptions and possible misinterpretations of vacuum with respect to its use in the canning field. Some of the inaccuracies inherent in the present methods of measuring vacuum also merit serious consideration.

While the elimination of oxygen may be accomplished by other means such as packing in atmospheres of inert gases, these will not be included in this discussion.

Reasons for Vacuum

There are several reasons for obtaining vacuum in canned foods. These include: the maintenance of can ends in a concave position during normal storage; the reduction of oxygen; and the prevention of permanent distortion of can ends during thermal processing. For a few products, the adequacy of the thermal process itself is based on a rather high initial vacuum in the can.

The technique employed from the very beginning of canning has been such that a vacuum has resulted. Bacterial spoilage usually results in gas formation which causes bulging of the can ends. Consequently, any distortion of the end from the normal concave shape is taken as an indica-

tion of spoilage by the industry and by the consumer.

A low oxygen content in canned foods is desirable to minimize adverse chemical changes in the product, such as oxidation of fats or vitamins, to prevent discoloration in some products, and also to reduce internal corrosion of the can. Some products tend to corrode the container with the liberation of hydrogen. With such products a headspace under fairly high vacuum is necessary to permit the accumulation of the liberated gas without distorting the ends. There are also a very few products that liberate gas from chemical changes in the product, the gas in this instance being carbon dioxide. These also require headspace under high initial vacuum for the same reasons as those products that are prone to form hydrogen springers.

During thermal processing there is considerable expansion of the can contents. This may result in permanent distortion of the ends, particularly in larger can sizes unless provision is made for this expansion without the development of undue pressure within the can. This is accomplished by providing adequate headspace under vacuum, also, in some instances counterpressure on the exterior of the can during cooling is necessary. This latter procedure is familiar to most of you under the name of "pressure cooling."

There are a few products in which the thermal process is dependent on the maintenance of high vacuum. In the case of the vacuum-packed vegetables, for example whole grain corn, where only a small amount of brine is present in the container, the heat transfer is obtained by means of water vapor given off by the boiling brine condensing on the surface of the exposed solids. Low vacuums result in higher initial temperatures being required to start boiling of the brine. Also substantial quantities of air or other gases in the can will decrease the rate of heat transfer to the exposed solids. The time and temperature employed for the standard thermal processes for these products are based on certain specified vacuums, usually over 20 inches. A decrease in vacuum below a specified minimum may result in a decrease in process efficiency of 5 percent or more per inch decrease in vacuum.

In some products, particularly some meat products, packed in cans having large flat areas, it is necessary to maintain contact between these flat surfaces and the product for satisfactory heat transfer during thermal processing. With these products counterpressure is usually imposed during the process. A substantial amount of air left in the can may result in poor heat transfer. Also, some of these products are compressed by the flat portion of the can during cooling, resulting in a solid mass suitable for slicing; for example, luncheon meat and whole ham.

Measurement of Vacuum

Before the development of mechanical gauges, vacuum was measured by use of a glass tube with one end immersed in a vessel of mercury and the other end connected to the chamber under vacuum. The height to which the mercury rose in the tube was an indication of the extent of evacuation of air that had been accomplished. Atmospheric pressure will only support a mercury column of roughly 30 inches; consequently the maximum vacuum normally obtainable is limited to about 30 inches, or to that of the barometric pressure prevailing at the moment. Since the unit for expressing vacuum had been established as inches of mercury, it was natural that mechanical gauges would be be calibrated to read in the same units. The mechanical gauge in common use for measuring vacuum is the Bourdon tube type. This gauge is basically the same for pressure or for vacuum.

The construction of the Bourdon tube is shown in Figure I. The flattened tube tends to straighten when the internal pressure is increased and tends to curl up when vacuum is applied. By attaching the free end of the tube to a mechanism that turns a pointer and then calibrating a scale that corresponds to the movement of the end of the tube, the motion can be made to indicate the difference in pressure existing in the tube compared with atmospheric pressure.

FIGURE I

Bourdon Tube Assembly

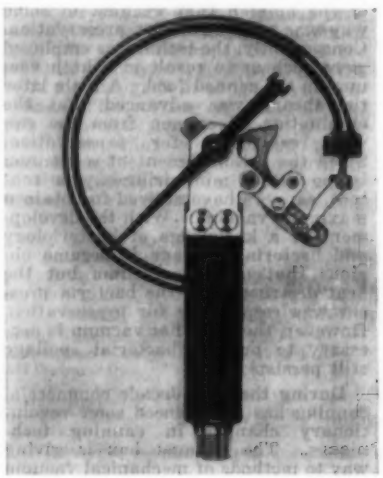
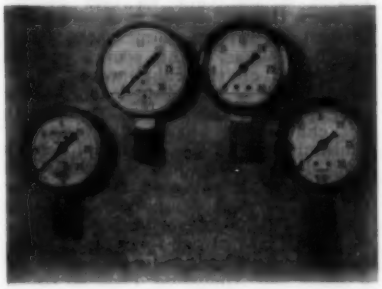


FIGURE II

Gauge for Measuring Can Vacuum



Atmospheric pressure varies from day to day and also decreases with an increase in altitude slightly more than 1 inch for each 1,000 feet.

In this connection it is interesting to note that a can having 10 inches true vacuum at sea level would only have approximately 5 inches in Denver and a slight pressure on top of Pikes Peak. Conversely the vacuum would increase in cans closed at high elevation and removed to lower altitudes.

About 40 years ago Young adapted the Bourdon tube gauge for measuring can vacuums by equipping it with a hollow puncture tip surrounded by a rubber sealing ferrule. The standard vacuum gauge is usually supplied with a male thread. This is satisfactory for the usual use of vacuum gauges in continuous vacuum systems. However, it was early recognized that the volume of air in the Bourdon tube and other hollow parts of the testing unit gave some error in the measurement of can vacuums. To minimize this, a gauge having a small internal volume and a short assembly was supplied for measuring can vacuum, as shown in Figure II.

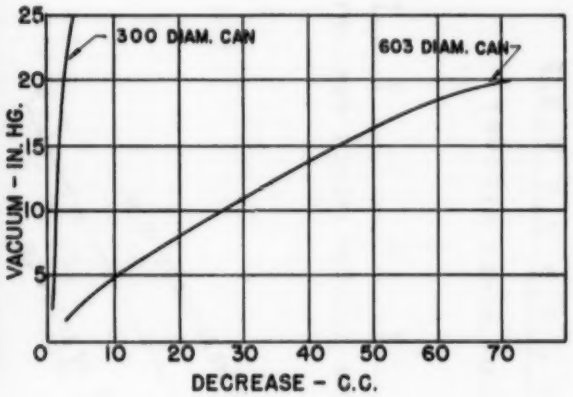
The gauge at the left (Figure II) is the type that was commonly used before World War II. This gauge and puncture tip assembly have a volume of roughly 3 ml. During the war, gauge manufacturers standardized on the more popular types of gauges and restricted the number of different types manufactured. The gauge most convenient to use is in a 2½ inch case. Unfortunately in standardizing, the gauge companies discontinued this gauge. Consequently gauges purchased during or since the war are similar to the two in the center of Figure II and have from 4 to 6 ml capacity. Also the gauge with the female connections is only available on special quantity orders. A vacuum gauge is sometimes encountered like the one shown on the right. In this instance the total volume of the gauge, pipe cou-

FIGURE III

Continental's Gauge Checking System

FIGURE IV

Decrease of Headspace Volume due to End Distortion



pling and puncture tip may be as much as 8 ml.

Sources of Error

In the measurement of the vacuum in canned foods there are several sources of error. These are:

1. The accuracy of the gauge itself.
2. The distortion of the can end at the time of measuring the vacuum.
3. The temperature of the product.
4. The volume of air at atmospheric pressure in the gauge in relation to the volume of the headspace under reduced pressure.

If all of these factors were known and the headspace determined accurately, it would be relatively easy to calculate the true vacuum from the gauge reading.

The accuracy of the gauge itself is obviously important and should be determined by checking it against a standard test gauge and should be frequently rechecked as the calibration will change with continued use. The changes that normally occur are due to the accumulative effects of wear in the gear mechanism, changes in stiffness of the Bourdon tube, etc.

The distortion of the can end at the time of measuring the vacuum cannot be avoided entirely, but can be minimized by using a gauge with a sharp puncturing needle and puncturing near the side where the end has maximum resistance to distortion. The distortion referred to here is only that due to a change in contour of the end brought about by pressure applied to pierce the tin plate.

The temperature of the product at the time of measuring the vacuum can make a substantial difference in the vacuum reading, if the temperature is very high or very low. Measurements should be taken as close to average storage temperature as possible.

The factor that normally is responsible for the greatest error in vacuum measurement is the air at atmospheric pressure in the gauge and puncturing assembly when the reading is taken. This error varies directly with the volume of the gauge assembly and with the true can vacuum, and inversely with the headspace volume. If the volume of the gauge and puncturing assembly is known and the headspace volume determined accurately, it is a relatively simple matter to correct from a gauge reading to a true vacuum. Most people using vacuum gauges have no knowledge of the actual volume of the gauge and puncturing assembly. In Continental's laboratory there have been occasions when it was necessary to make corrections for errors in conventional vacuum measurements. In order to determine the gauge volume, the set-up shown in Figure III has been made part of the gauge checking system. The gauge and puncture tip assembly volume can be easily determined by use of this equipment.

By measuring the vacuum using a calibrated gauge of known volume and then accurately measuring the headspace of the can, the true vacuum existing can be determined by substituting the measured values in the formula:

$P(V_1 + V_2) = P_1V_1 + P_2V_2$

V_1 = volume of gauge

V_2 = volume of headspace in the can

P_1 = pressure of air in gauge (Barometric)

P_2 = pressure in can

P = final pressure when can and gauge are connected

It is necessary to determine accurate headspace values in order to calculate correct vacuums since the tin can is not a rigid container and the ends are drawn in, decreasing the volume of the container. The amount of this volume change, which is confined entirely to the headspace, varies with the vacuum and with the contour of the can end, and the stiffness of the tin plate used in making the end. Consequently, unless careful measurements are made to determine the amount that the end is distorted under the influence of vacuum, accurate determinations of the headspace volume cannot be made. Figure IV shows the approximate deflection of normal can ends of standard contour for two can sizes under the influence of vacuum. With multi-beaded ends a volume change due to end deflection is approximately 25 percent greater than that shown for the standard ends. Ends from plate of different stiffness due to either thickness or temper will deviate more or less depending on stiffness.

The necessity of obtaining correct vacuum readings might be cited from the following practical examples:

A certain canner planned to replace his closing machines with new higher speed closing equipment equipped with steam flow closure. The steam flow equipment already in this plant consisted of an early model and also one of the latest improved design. Cans taken from the two lines and vacuums measured with the same gauge indicated that the earlier design of steam flow equipment was giving the higher vacuum. Since only the newer design had been constructed for the higher speed closing equipment, the question was raised as to whether or not special equipment of the old design should be made for this new closing machine. Tests were

FIGURE V

Nomogram for Converting Gauge Vacuum in 202 Diameter Can to True Vacuum Using 3 Mi. Bourdon Tube Vacuum Gauge

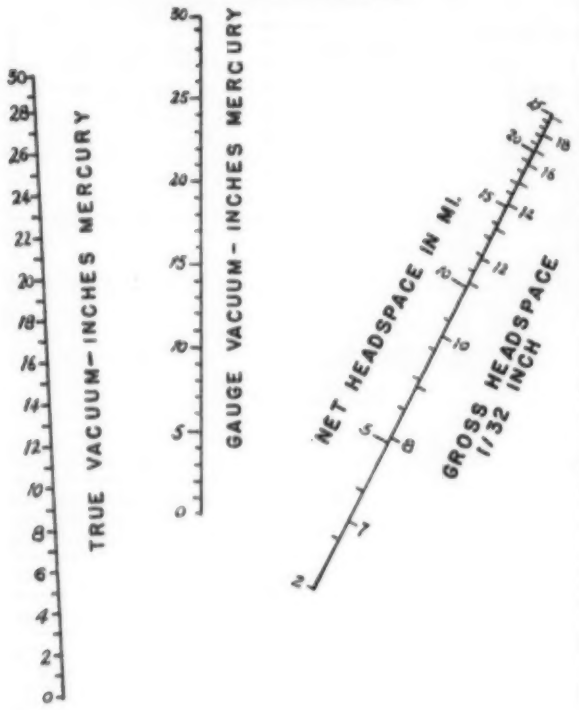
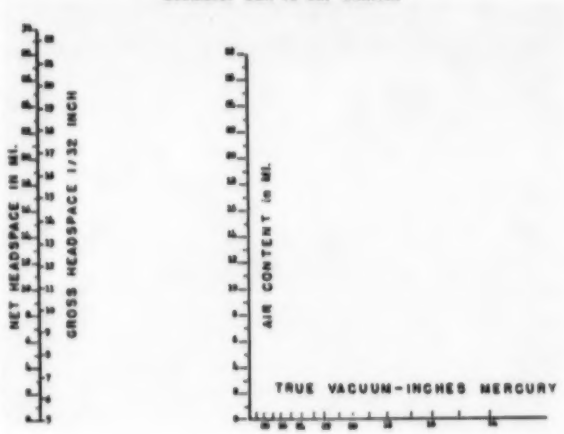


FIGURE VI

Nomogram for Converting True Vacuum in 202 Diameter Can to Air Content



conducted on the existing equipment in the customer's plant. Both existing lines were operated at the same speed and with the same batch of product. A large number of samples were taken, and headspace and vacuum measurements carefully made. On converting these measurements to true vacuum in the can it was shown definitely that the newer steam flow equipment actually was giving the expected higher air removal. The apparently lower vacuum readings on this line were due to the difference in fill, the net headspace being smaller on the newer installation. These were 202 diameter cans and the difference in fill, while averaging only $\frac{1}{32}$ of an inch, made a substantial difference in the relative volume of the small headspace in this size of can. The observed gauge readings were shown to vary between 11 to 16 inches while the true vacuum was actually 22 to 23 inches.

Corrected true vacuums were in another instance found to be of considerable value in determining headspace air. The headspace volume was in this case also quite small and specially designed equipment would have been required for actual analysis. However from net headspace measurements and corrected true can vacuums, the amount of air present could be easily calculated and probably considerable time saved. Nomograms shown in Figures V and VI were used for rapidly making the necessary calculations.

In an effort to minimize the effects of air in the vacuum gauge system one of the companies supplying closure for glass introduced a gauge equipped with a puncture tip having the opening from the side underneath the rubber ferrule. This gauge can be prevacuumized by puncturing several cans. This is satisfactory where a large number of cans are being examined and the vacuum is fairly constant throughout the entire lot. However, this gauge is subject to the same errors as the gauge in more common use as it is difficult to estimate at what level to prevacuumize the gauge for measuring vacuum in a single container. If the gauge is prevacuumized to too high a level, the true vacuum might be below the gauge reading rather than above as is usually the case with conventional vacuum gauges in general use.

A new gauge has recently been described by Morpeth.[1] This gauge largely overcomes the errors due to air in the gauge and to variations in can headspace volume. By taking a reading on this gauge and then pushing a button which releases a volume of air equal to that originally in the gauge and taking another reading on the gauge, the true vacuum can be determined by suitable calculations. This is probably the best system that has been developed for general use in determining true vacuum in canned foods. However, even this gauge is subject to error due to deformation of the ends at the time of puncturing and also to change in volume of the headspace by springing out of the ends as air from the gauge or air from the reservoir is introduced into the headspace.

In the foregoing the common errors in measuring vacuum and set-ups necessary for corrections have been summarized. With the introduction of more accurate gauges for measuring vacuum, it would be well for those canners packing products wherein the thermal process is based on maintenance of a certain minimum vacuum in the can, to make due allowance for the difference in vacuum determination made by the conventional procedure as compared with methods approaching true vacuum. In general the conventional determination gives results lower than the actual or corrected can vacuums.

The armed forces and certain other buyers of some products have minimum vacuum requirements written into their specifications. These usually mean measurements taken with the ordinary gauge. Consequently, if a corrected gauge is used, due allowance should be made for the difference between the true vacuum and the ordinary observed gauge reading.

[1] Morpeth, J. C., *Food Manufacture*, p. 460, Oct. 1951, *The Canner*, p. 10, Oct. 13, 1951.

Technical Background for Further Tin Conservation

By R. R. Hartwell,
American Can Company

In view of the complications arising from tin pricing, leading to import restrictions on this metal, there is a possibility that containers face further limitations on the use of tin. Because of this situation, it seems desirable that the food canning industry should have an appreciation of the technical principles behind tin conservation, particularly as they refer to the possibilities of making further reductions in tin consumption without serious effect on container shelf life or limiting the number of containers available. For this reason, and because it has been almost exactly one year since NPA Order M-25 first became effective, it is also thought an appropriate time to comment on certain of the M-25 provisions.

So far as is known, from the technical viewpoint M-25 has in general worked out satisfactorily. There have been instances where revisions have had to be made due to misunderstandings in product requirements or difficulty in converting equipment but considering the size of the task, these have been in the minority and little further adjustment appears necessary for these reasons. Although some 30 per cent of all tin plate made in 1950 was #25 electrolytic plate* and it had been extensively used for such products as animal food and shortening over a period of several years, the widespread use of this grade for processed foods was the provision of M-25 drawing most comment and for that reason worthy of special mention here. Because it is well known that rust resistance is related to tin coating weight, this measure caused some concern. It is better appreciated now that the basis for the use of #25 electrolytic plate use lay in the knowledge that tin coating weight alone never determines whether rust will form or be absent under a given set of conditions and that the only positive rust prevention methods were the use of outside enamels or the elimination of the more extreme conditions of packing or storage. It is too early for a full assessment of the effects of the use of #25 plate but it may be said that so far the results are as encouraging as expected. This is not to say that rusting has been entirely absent, because some has always occurred with #50 and hot dipped plate where conditions were not satisfactory. It is rather that so far rusting appears to be no more prevalent on the #25 than on the #50 plate it replaces. This is not only true on bodies, which were not outside enameled, but also on the limited number of outside plain ends used last year.

Before commenting on future possibilities for tin conservation, it is instructive to consider the current distribution of tin among the categories shown in M-25. An estimate of the situation which will prevail during the one-year life of the current M-25 revision appears below. It will be appreciated that there are limits to the accuracy of such estimates as those contained in Table I because, among other reasons, it is necessary to make assumptions regarding the probable volume of the various packs. It is also necessary to attempt to take into account such situations as exist for evaporated milk where an appreciable amount of #75 electrolytic plate is used where M-25 permits hot dipped.

In view of the relative amounts of tin used, particularly as related to steel consumption, it seems clear that any hope for substantial savings must center about the fruit, vegetable, and dairy groupings because these use three quarters of all tin consumed. For this reason, comments on future possibilities will be restricted to these fields.

The most important technical point limiting tin conservation is the "corrosion shelf life" of the container; that is, the length of time the container will withstand the corrosive action of its contents before becoming a hydrogen swell or perforation. It is well known that the *degree* of corrosiveness exhibited by different foods varies widely, as does the *type* of corrosive attack. Basic knowledge of these factors has been applied in WPB Order M-81 as well as to its successor, NPA Order M-25, and of course explains why #25 electrolytic plate is indicated as being entirely adequate for many purposes and the heavy coatings of hot dipped plate necessary for others. Since these limitation orders have received the benefits of the research and experience of some ten years, the obvious has long since been put to use and further tin conservation depends on (a) a new material with lower tin content, but with the performance of hot dipped, (b) extension of principles which are already established, but not fully applied for reasons other than corrosion performance, and (c) new types of container construction.

New Materials

At present it appears that considerably more than half the tin consumed under the M-25 provisions will be in the form of hot dipped plate. In view of this, it will be apparent that by far the single most effective way to reduce tin consumption would be to devise some substitute for this material. Hot dipped uses include some plate for fully enameled cans in the fruit and vegetable categories, but the largest part of it is used for plain cans. In the main, these represent applications where fully enameled containers cannot be used because of effects on the quality of the product and this is one reason it is not possible to take advantage of enameled electrolytic plate to replace hot dipped as is done for many other foods. If the substitute must be plain, and considerable tin is required, heavily coated electrolytic plate is the obvious solution because this process permits coating the strip with different weights of tin on the two sides, a procedure which has never been accomplished on a practical scale with hot dipped plate. Such a "differentially" coated plate, for example with tin plated at the rate of 1#/BB on one side and .25#/BB on the other would save about 45 per cent of the

TABLE I

Tin and Steel Consumption as Related to Commodity Classification

M-25 Category	Percent Tin Consumed		Percent Steel Consumed		Av. Tin Ctg. (#/BB)	
Fruit	32.6		17.0		1.00	
Vegetables	29.7		22.0		.75	
Tomato Products Only		8.8		5.7		.85
Fish	4.8		5.9		.45	
Dairy	14.5		8.5		.95	
Evaporated Milk Only		11.6		6.8		.95
Poultry	0.2		.4		.20	
Meat	5.1		4.0		.72	
Miscellaneous Food Products	10.3		26.3		.21	
Beer Only		4.6		10.2		.25
		1.0		2.3		.25
Non-Food	2.8		15.8		.10	
Totals	100.0		100.0		.85	

* To avoid confusion with hot dipped plate it is customary to refer to electrolytic tin plate carrying tin coatings of .25, .50, .75#BB, etc., as #25, #50, #75, etc.

tin now going into 1.25 hot dipped plate for fruits and vegetables* if it were technically satisfactory for these purposes. Substantial semi-commercial quantities of differentially coated plate have been made and in principle the process appears a perfectly feasible one, although more difficult for some producing plants than others. It is also possible that full-scale use of such material would require the construction of additional tinning facilities because the speed of the process is limited by the rate at which the heavy coating can be deposited. There are few electrolytic lines in existence which can make heavy coatings at economical speeds.

It has been demonstrated for several years that #50 is adequate for the outside of the can under most conditions and we appear to be well on the way to establishing similar data for #25. In view of the potential tin savings and the fact that #100 coatings have been possible ever since electrolytic plate became available it may seem strange that such tin plate has not attained a widespread use.

The reason for this apparent lack of enthusiasm for a new material arises from the erratic corrosion shelf life behavior that has been manifest so far. For such a material to be widely useful it is necessary to be able to depend on relatively consistent results and from Figure I it will be apparent that such a situation certainly did not prevail in 1943. The data in Figure I represented materials made by all existing plating processes and nearly all mills producing were included. While grapefruit juice was used in this particular experiment, the type of data was not unique to the product and similar results could be obtained in plain cans with any product on the fruit list. Considering this, and the fact that the real standard for substitution in tin conservation is either to obtain the same shelf life as given by the container previously used or at least one long enough to leave no doubt of a successful commercial experience, no further comment appears necessary to demonstrate why few people felt they could afford to be interested in such material unless it became possible to make some sort of selection. To a considerable extent, the same situation exists today.

To those interested in container corrosion problems, the striking point about such data as those in Figure I was the indication of the future potentialities in electrolytic plate, for some electrolytic plate of each coating weight gave at least as long a corrosion shelf life as the 1.25 hot dipped plate of the period. Because it probably is not widely known in the canning industry, it should be said that since 1943 a great amount of work has been done by both the steel and container industries in finding and correcting the causes of these variations, as well as testing hundreds of lots of plate thought to represent possible means of solving the problem. Commercially, we appear to be part way between the situation as it existed in 1943 and the point of obtaining results sufficiently consistent to permit the desired extensive use of heavily coated electrolytic plate. The details of this problem have no place here but it may be said that the cause of the erratic corrosion behavior is fairly well established and the nature of the steel surface, both as it occurs in the steel as ready for plating and as it is influenced by the operations on the plating line is considered to be responsible. Much can be done to minimize the former by changes in steel processing methods and for this purpose many of the producers have spent large sums for equipment. The exact nature of the other factor is less well understood, but one plating process is known to have an inherent advantage in this respect. Successful handling of both factors will be necessary if the electrolytic product is to be used to full advantage as a substitute for hot dipped plate and it seems ironic that some tin plate producers have the means to control the first factor and others the second, but none as yet has both on a commercial basis.

Small-scale lots of material considered to represent a successful solution to the above problems have been made and Table II contains a summary of the corrosion results obtained from 100 ° F. storage of one of these with results from the same steel, hot dipped, included for comparison. The same factors which improve steel for electrolytic plate are to some extent also helpful for the older material, so other hot dipped lots not receiving such benefits are included because they represent the real standard for comparison.

FIGURE I

Shelf Life Variation in Individual Lots of Electrolytic Plate of Indicated Coating Weight

(1943 Pack—Grapefruit Juice in No. 2 Cans)

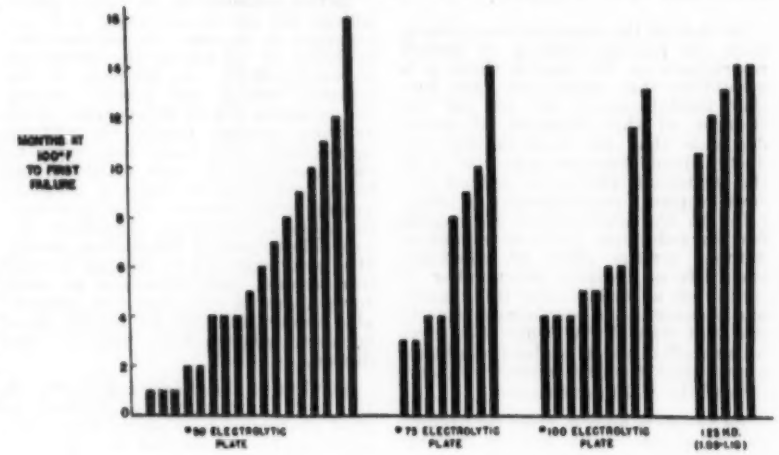


TABLE II

Performance of Satisfactory #100 Electrolytic Plate

Months at 100° F. to Produce First Corrosion Failures

	Special Steel			Other Steels	
Plain Cans:	#100	1.50	1.25	1.50	1.25
Dried Prunes in Water	7 Mo.	8 Mo.	7 Mo.	7 Mo.	7 Mo.
Peaches	19	19	—	17, 21**	—
Grapefruit Juice	(9.2)*	19	—	13, 17	16
Tomato Juice	(2.3)	—	(1.1)	—	(2.8)(7.3)(11.1
Enameled Cans:					
R. S. P. Cherries					
Non-Striped	11	12	—	9, 7	9
S. S. Striped Cans	14	—	—	—	

* Figures in parentheses are vacuum loss, shown because corrosion failures have not occurred at time of last examination which was 22 months for grapefruit juice and 26 months for tomato juice.

** Has coating about 15 percent higher than average for 1.50 plate.

* On the basis of these figures it would appear 50 percent was the correct figure. However, hot dipped plate is classified on the basis of tin "yield" figures, whereas electrolytic terminology refers to coating on the sheet. With both on the same basis, 45 percent is thought to be a more reasonable estimate.

The preceding comments have been directed primarily to variations in the quality of heavily coated electrolytic plates. As a practical matter, it will be recognized that in considering substitution of electrolytic plate for plain hot dipped the corrosiveness of the product is also an important factor. In other words, if some degree of selection can be exercised in the tin plate, and it is used for a product mildly enough corrosive so that even with the expected variations the corrosion shelf life is longer than the period required for merchandizing and consumption, substitutions become possible on a limited scale. This accounts for the appearance of #75 in M-25 for part of the evaporated milk can, its substantial commercial use in other parts of the same container where hot dipped is permitted, as well as commercial trials of #100 during the past two years for several products, notably tomato juice. Increased use of heavy electrolytic coatings have for some time awaited only further improvement in the consistency of its corrosion performance. In view of this, no purpose would be served by its inclusion in M-25 for widespread use because such a step would not be on a sound basis until material with the characteristics described above is available in sufficient volume.

It would be unfortunate to leave the impression that effective commercial solution of the problems described above would automatically permit entire replacement of hot dipped by electrolytic, for there are indications of other problems being involved. There are many, for example, who believe certain products known to show unusual reactivity with tin will be among the last to employ electrolytic plate because of some evidence that it may tend to vary more than hot dipped in this respect. Similarly, it is understood that to a large segment of the evaporated milk industry the non-uniform type of attack on the tin coating often found on electrolytic plate is of more concern than the usual criterion of container corrosion, but it seems likely the latter problem will not be so difficult of solution as those mentioned above. In spite of these and similar considerations it is thought that the majority of the hot dipped plate on the fruit list and a substantial portion of that on the vegetable list could be replaced by electrolyltic plate if the proper grade were now consistently available.

Extension of Established Principles

Compared with potential savings available through a satisfactory heavily coated electrolytic plate to replace hot dipped, there is relatively little to be gained by any other single change. However, there still remain places where extension of previously known principles could produce some additional savings and one of these concerns the so-called "combination can"; that is, the container with plain hot dipped body and enameled electrolytic end. Apparently because the plain body is capable of furnishing some type of protection to the enameled electrolytic end, such containers quite typically perform equally well, if not better than the plain completely hot dipped containers they replace and it may be expected this type of container will be further exploited.

Additional tin conservation from this type of container may be expected along two directions, one of which is simply the extended use of the combination can. There are currently a few places, especially for citrus and pineapple products, where the plain completely hot dipped can is employed, not because the combination can lacks corrosion resisting properties but because the problem is one of developing suitable enamel systems for the ends. This subject has been under study for some time and if successfully concluded, there is no technical reason to prevent this increased use of the combination can.

There is a second aspect to future tin savings by the use of enameled electrolytic ends. From a number of experiments, for which the data in Table III may be regarded as typical, it will be noted that the tin coating weight on the enameled ends of combination cans may be varied over a wide range with little effect on corrosion shelf life.

Such information as the above is the basis for the use of #25 for the ends of combination vegetable cans. Fruit can ends have remained at #50 because it was thought well to gain experience on the extensive use of #25 for vegetables first, but on the basis of corrosion shelf life alone it seems likely this is one of the places some adjustment is likely in the future.

Still further possibilities exist in the use of CTS (chemically treated steel) plate or some other tin-free material with comparable performance. During the previous emergency ends of such materials were used satisfactorily for certain vegetable and other types of products so no further demonstration of their value as tin conservation measures for these purposes seems required. However, their use for ends of more acid products such as fruit, which is suggested by the above data, has never taken place on a commercial basis and constitute a possible further means of tin conservation. In view of the nature of these products, some have regarded this substitution with some scepticism but the data are typical of those obtained on many occasions and the principle on which they depend has been thoroughly tested. It should be pointed out that tin conservation by the use of CTS is farther in the future than some of the other potential measures because such a material is not in commercial production. Since its performance for the products for which its use was required by Order M-81 was satisfactory, it is apparent the reasons for its current non-availability are more matters of economics than they are technology.

New Types of Container Construction

A substantial portion of the tin savings effected under M-81 were due to the discovery of what might be termed a new type of container construction; that is, the combination can. It would be encouraging to report that something of a similar nature and importance could be looked to for assistance in the current emergency, but this is not the case. However, one development of this nature, side seam striping, is worthy of mention because some tin savings could become available through it now and more in the future.

The shelf life of containers for strongly corrosive products, for which M-25 provides 1.50 plate, is usually considered directly proportional to

TABLE III

Effect of End Tin Coating Weight on Performance of Combination Can

Peaches

	Body	End	Months to First Failure at 100° F.	Vacuum loss at 70° F.
1942	1.25 Pl	1.25 Pl	12 Months	3.4" after 70 months
	1.25 Pl	1.25 Pl	12	6.1
	1.25 Pl	#50 En	11	1.8
	1.50 Pl	#10	13	1.3
	1.50 Pl	CTS En	12	2.2
1943	1.25 Pl	1.25 Pl	10 Months	1.3" after 57 months
	1.25 Pl	#75 En	10	1.2
	1.25 Pl	#50 En	10	0.6
	1.25 Pl	#10 En	11	0.7
1944	1.50 Pl	1.50 Pl	18 Months	0.2" after 46 months
	1.50 Pl	#50 En	18	0.0
	1.50 Pl	#50 En	16	0.0
	1.50 Pl	#25 En	18	0.2
	1.50 Pl	#10 En	17	0.4

the tin coating, assuming other factors remain the same. In other words, the use of 1.25 plate for these applications will reduce shelf life about 20 per cent unless something to counteract the lowered tin coating can be devised. In plain cans there is no immediately applicable way of doing this, but for enameled containers which use the bulk of the 1.50 plate, it appears possible to take advantage of the fact that the side seam tends to be the weakest point so far as corrosion is concerned. Side seam striping, that is, applying a coat of enamel to the side seam area after soldering the container, is an effective way to extend corrosion shelf life and could well make possible the use of 1.25 plate for these purposes. It will already have been noted that Table II contains a demonstration of this principle.

Because the amount of tin used as 1.50 plate is quite small these potential savings would have little effect as compared to the total consumed. However, it seems likely that side seam striping will assume a greater importance as a means of substituting heavily coated electrolytic plate, when satisfactorily developed, for enameled hot dipped. With the aid of the differential coating principle, savings roughly three-fold those possible by the substitution of 1.25 for 1.50 could be achieved.

Summary

So far as their immediate effect on tin consumption are concerned it appears the measures outlined above would reduce the total tin consumed in the following amounts:

Replacement of 1.50 by 1.25 due to side seam striping	...
less than 1 percent.	
Reduction of tin coating on fruit ends	
From #50 to #25	1.2
From 50 to tin free steel (Such as CT8)	2.4
Reduction of plain hot dipped fruit ends to #50	2.3
Use of tin free ends on M-81 basis CT8	3.4

Although it is clearly much larger, it is difficult to secure agreement on a comparable figure for the introduction of #100/25 differentially coated electrolytic plate because it depends on the particular estimate of the problems remaining after those discussed here have been solved. However, excluding milk, it is thought 10-15 per cent of the total tin consumed for tin plate could be saved now and the potential is, of course, nearly half the tin employed for hot dipped. In other words, we are arriving at the end of tin conservation by conventional methods. What can be done in the future depends increasingly on the tin plate industry.

The Retention of Carotene During the Canning of Tomato Juice

By N. H. Strodtz, T. E. Blumer and L. E. Clifcorn, Continental Can Company

Data reported in the National Canners Association bulletin *Canned Foods in Human Nutrition* (1) as a result of work (2, 3) sponsored by the National Canners Association—Can Manufacturers Institute Nutrition Program shows a wide range of retention of carotene during the canning of tomatoes and a surprisingly narrower range of 60 to 74 percent with an average of 67 percent on a dried solids basis for the retention of this nutrient during the canning of tomato juice. Since carotene is generally known to be quite stable to canning operations, the factors responsible for these results are not clearly understood.

The means by which carotene might conceivably be lost during tomato juice processing are from mechanical, oxidative, or thermal causes. However, several authors (4, 5, 6) have considered it unlikely that oxidative losses of consequence occur, except in oils, fats, or non-aqueous media. Certain plant materials, such as horseradish, have been shown to contain highly active oxidation-promoting enzymes (7), but there is no evidence reporting such substances in tomatoes. The absence of evidence of oxidative loss, together with the relatively low temperatures and short processing times employed in the canning of tomato juice, suggested that efforts might profitably be directed to the study of mechanical losses, such as result from screening and finishing operations.

The analytical procedure used to determine carotene was essentially that recommended by the Association of Vitamin Chemists (8). It was found necessary to adopt more rigorous extraction techniques than those specified in the standard procedure, when working with tomato seeds and cores. Carotene recovery tests using the revised technique resulted in recoveries of 96 percent or better, well within the acceptable range for chromatographic techniques.

A preliminary experiment to investigate the effect of mechanical losses was conducted as follows:

A lot of quartered fresh tomatoes was divided into two portions. One portion was analyzed for carotene as representing the original material. The other was weighed, crushed thoroughly, and pressed through several layers of cheesecloth, thus separating the juice from the skins and seeds. In this operation a considerable amount of pulp was also removed, resulting in a juice that was much thinner than average commercial tomato juice.

TABLE I

Laboratory Study of Carotene Retention During Tomato Juice Extracting Operations

	Screen size	Weight *Kg.*	Carotene Concentration *Mg./100 gm.*	Total Carotene *mg.*	Percent of Original Carotene
Cold Break:					
Original	0.023 in.	6.80	0.680	46.2	....
Juice	0.023 in.	5.69	0.656	37.3	80.7
Skins, Seeds, Etc.	0.023 in.	1.10	1.021	11.2	24.3
Total Carotene Recovery					105.0
Carotene Retention			96.5%		
Carotene Utilization Efficiency				80.7%	
Original	0.033 in.	7.09	0.680	48.2	....
Juice	0.033 in.	6.28	0.644	40.5	84.0
Skins, Seeds, Etc.	0.033 in.	8.05	1.102	8.9	18.5
Total Carotene Recovery					102.5
Carotene Retention			94.7%		
Carotene Utilization Efficiency				84.0%	
Hot Break:					
Original	0.023 in.	7.37	0.641	47.3	....
Juice	0.023 in.	6.26	0.584	36.5	77.2
Skins, Seeds, Etc.	0.023 in.	1.12	1.056	11.8	24.9
Total Carotene Recovery					102.1
Carotene Retention			91.3%		
Carotene Utilization Efficiency				77.2%	
Original	0.033 in.	7.40	0.641	47.4	....
Juice	0.033 in.	6.14	0.537	34.2	72.3
Skins, Seeds, Etc.	0.033 in.	1.27	1.115	14.1	29.7
Total Carotene Recovery					102.0
Carotene Retention			87.0%		
Carotene Utilization Efficiency				72.3%	

These fractions were weighed and analyzed for carotene with a recovery of 97 percent of the original total carotene. The 97 percent recovery was indicative of the stability of carotene during the course of the experiment, and confirmed previous statements concerning the oxidative loss of carotene, under operations at room temperature. However, the presence of a considerable amount of carotene in the solids fraction suggested the need for a further investigation of mechanical losses.

Accordingly, a pilot plant operation was set up, in which fresh tomatoes were chopped in a Fitzpatrick Comminuter, weighed, then passed through a laboratory size "Indiana" finisher, thus simulating a cold break process. The resulting juice was weighed, as were the waste skin and seed fractions. Two finisher screen sizes were used. Additional runs were made in which the material was heated before finishing, thus simulating a hot break operation. Carotene analyses on the various fractions resulted in the data shown in Table I.

As before, the consistently good carotene recoveries amply demonstrated the absence of oxidation. A very substantial percentage (25-30 percent) of the carotene was found in the refuse. These data show that the carotene concentration in the skins, seeds, and other refuse was about double that of the finished juice and that about 15 to 17 percent of the original weight of tomatoes was lost as refuse. It was considered likely that the small-scale pilot operation resulted in far more residual material than would ordinarily be encountered in commercial production. It will be noted from the carotene retentions shown in Table I that the series of results calculated on the basis of the carotene concentration of the original tomatoes and finished juice did not agree with the carotene utilization efficiencies, which term has been defined as the extent to which the carotene present in the original raw tomatoes was utilized in the finished juice. This lack of agreement can be expected and will be clarified later in this report. The obvious desirability of investigating commercial operations prompted the extension of similar techniques to two Indiana canneries during the 1951 season.

Carotene retentions from these surveys reveal 81.4 percent and 88.3 percent carotene retention for two hot break operations and 81.9 percent retention for one cold break operation. These values are distinctly higher than the highest reported on a dried solids basis in earlier surveys of carotene retention during tomato juice canning operations in our industry nutrition program, and higher than the average over-all carotene retentions which have been reported, of 63 percent on the basis of "as received samples," and 67 percent on the basis of dried solids samples.

As has been mentioned, data previously reported on carotene retentions during the canning of tomato juice have been mainly derived from a comparison of the carotene content of the dried solids from the juice after canning with that of the original chopped tomatoes. When the nutrient under consideration is an integral part of the solids, this makes the situation more complex than when the nutrient is soluble in the liquid and not fixed in its entirety with the solids, particularly in evaluating a process where some of the preparatory operations are specifically designed to take out solid materials. One can visualize a situation where the solids being removed have the same composition as the solids remaining in the finished juice, in which instance on the basis of the vitamin content of the dried solids, a 100 percent retention of the nutrient would be observed while actually a significant loss had taken place. This hypothetical case is similar to extractor and finisher operations in tomato juice production. The removal of skin, seed, and pulp fractions in these operations, however, reflect materially on the cannery's total carotene balance sheet and also result in a lowered carotene content of the canned juice on an "as received sample basis."

By calculating the total carotene content of the original tomatoes, the various waste portions, and the final juice after canning, one obtains a balance sheet from which the utilization efficiency of carotene in the cannery may be readily apparent. These values of 82.5 percent and 67.1 percent for two hot break operations and 62.2 percent for one cold break operation should not necessarily be in agreement with the over-all carotene retentions for the finished canned product as calculated from the carotene content of the "as received" samples or with the value "over-all carotene retentions" calculated on the basis of the dried solids. The carotene utilization efficiency is a measure of the cannery's efficiency in retaining the total carotene in the tomatoes which have entered the plant in the final canned product, but does not necessarily reflect on the relationship of the carotene composition of the final canned product with that of the original raw tomatoes from which the juice was prepared.

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Current Developments and Prospects in Canned Food Standards

By H. Thomas Austern,
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One of the extraordinary attributes of human beings is their capacity, despite any emergent crisis or strain, to continue at the daily job. Two incidents during the Battle of Britain come to mind. During the height of the bombing there was the London housewife seated in a deep shelter calmly sewing on a set of new curtains for her living room. The other was a long cable received in Washington from a British government agency at a time when the world was watching whether Britain alone could hold off the enemy. The cable complained at length about a British subject named Breckinridge who had been denied a hacking license by a small New Jersey town which in a fervor of patriotism had ordained that only American citizens could drive taxis. Crisis or catastrophe, the British civil servant was doing his assigned regular job of seeing to it that the rights of Englishmen abroad were being protected.

In like fashion, even though today the food industry, along with the entire American economy, is straining to meet its assignment in the current defense program, I am confident that each of you continues to work assiduously at your regular job of product research and the development of better processing techniques.

Though this morning you have heard about tin conservation, this conference is equally devoted to those long-range peacetime tasks that make up the daily work of food technologists. In that area the technologist, the lawyer, and the administrator meet most actively, intimately, and perhaps most happily, in the cooperative work of formulating standards of

identity, quality, and fill of container for foods.

On earlier occasions, I have been privileged to survey with you the legal framework within which these food standards are erected and the role of the food technologist in their preparation (INFORMATION LETTER No. 1200, Jan. 31, 1947, page 75; INFORMATION LETTER No. 1271, Feb. 4, 1950, page 57). In the past, many have doubted whether this shotgun marriage of scientist and lawyer would beget anything but conflict and confusion. I am happy to report that this has not come to pass.

Some of the mental offspring reared in the public hearings of the past few years—and now dressed in the formidable clothing of a federal regulation—are neither as beautiful nor as effective as their intellectual parents thought at first they might become. But perhaps many in this room will agree that in the canning industry the research technologists, the lawyers, and their counterparts in the Food and Drug Administration have become an effective team on which there is no longer any need for alignment into offensive or defensive platoons.

This morning it is my happy assignment briefly to catalog for you the current state of the food standards program—to bring to your attention the progress to date in those standards which have been developed, promulgated, and often amended and perfected—to review those which are pending for official consideration either on completed hearing records or awaiting further hearing after additional investigation—and to venture some speculations as to those areas into which the food standardization program seems likely to move within the near future.

Lastly, I hope to stimulate your interest in some new ideas that are being explored in the application of statistical theories and methods in the fill of container field.

How far has the standardization program progressed? Considering that World War II caused practically a five-year interruption in the process, some of you may be surprised to learn the scope of the standards already issued. In an Appendix, I have endeavored to list all of those promulgated since 1939. As in everything else, methods of classification and statistical counting can always be challenged. If one tabulates the standards that are specified in separate regulations, the total comes to 165. But since one of these—for canned vegetables—includes 35 individual commodities from asparagus to turnips—the total properly might well be taken as 199.

Basically, the efforts to date have centered in 12 catgories of foods. The variety is striking. Cocoa products have been almost wholly standardized, as have cereals, alimentary pastes, and dairy products. Salad dressings, egg products, and oleomargarine are well implemented with standards. Virtually all canned vegetables and canned fruits have been preliminarily standardized, and many of these are now in their second round of achieving perfected identity standards, minimum quality standards, and standards of fill.

In all, a prodigious amount of industry and administrative effort has gone into this work.

Nor in surveying the accomplishment to date may one lose sight of those standards which have already gone through the hearing process, and are now pending for final administrative consideration. I have listed these in a separate Appendix. Those of you who desire to pursue the details may find them in the *Federal Register* citations. By way of illustration, many of you know the prolonged effort that has gone into the proposed standards for the various kinds of bread and enriched breads. The hearings on these have bridged almost a decade and have included a considerable amount of controversy about surface acting agents. Proposed standards for ice cream and frozen desserts likewise reflect a vast amount of industry and government work, as do those now in process for frozen fruits. In the canning field, the identity and quality standards for canned corn have been completed, and those on fill are still in process. Public hearings on pineapple have been completed on identity and quality, and here again further studies are in progress on fill of container.

Necessarily, no formal appendices permit relative evaluation of the scope or difficulty of the technical problems resolved in these standards. I venture to suggest that in the 30 separate regulatory paragraphs covering cheese products there has been far less work than in the 25 separate paragraphs which comprehend all of the standards for canned foods. Likewise, the seven egg product standards cannot compare in complexity with the three covering fruit preserves, jellies, and fruit butters. As Howard Smith once remarked, it is always the future standard on which one is not immediately working that appears to present less difficult problems.

In looking ahead, I hope I may be forgiven if I limit our attention to the field of canned foods alone. Of immediate interest is the continued work on fill of container for whole kernel corn. In addition, as many of you know, the Association's Laboratory staff and counsel have been examining since 1935, in conjunction with an industry committee, the intricate, and in many respects fascinating, problems unique to the development of standards for canned asparagus. Whether this effort will be sufficiently advanced to permit hearings in 1952 remains to be seen. Currently, the Association is also canvassing canner interest in a proposed amendment to permit the use of corn syrup in tomato catsup.

Turning next to canned fruits, it would be amiss not to pay one's respects to the splendid achievement of the Canned Pineapple Standards Committee. It may interest those who have criticized the public hearing process in standard making to learn that in approximately 3½ days it proved feasible to present comprehensive data, reflecting 10 years' study of identity, quality, and fill for all forms of canned pineapple and for pineapple juice. In that time 258 elaborate exhibits were presented through 19 witnesses. At the moment, intensive work is continuing to perfect pineapple fill of container standards—and in this endeavor some new theories, which I shall mention in a moment, are being tried out.

In the canned fish field, standards have been developed only for fill on shrimp, and for identity, quality, and fill on canned oysters. Extensive, and from many points of view, pioneering labor has been applied for almost two years in the development of standards for canned tuna fish. Both amateur and professional ichthyologists have had their day; and an experienced committee of food technologists has now taken over the work. It is not unlikely that this activity will prove to be the forerunner of canned salmon standards on which preliminary study has already been begun. The technical hurdles in achieving reasonable standards for canned fish products are formidable. Once again, the new problems find no controlling precedents in past work.

Recently, the United States Supreme Court declined to review the *Bireley* case. There, you will remember, the appellate court set aside a seizure of orange beverage that had been condemned on the ground that the addition of water, color, lactic acid, sugar, and orange oil to 6 percent of orange juice constituted an adulteration because the resulting product was deceptive. The appellate court disagreed and said that the test of deception was whether an ordinary consumer would think she was getting regular orange juice. In the absence of standards, the court thought there was no yardstick specifically to measure whether the orange drink had been made to appear better than it really was.

The Court suggested that

> "Adulteration is rested squarely on the deception potential of the product sold in relation to a familiar standard." (187 F. 2d, 967, 973).

On this basis it ruled that the only question for the jury, in the absence of standards was whether the ordinary consumer would confuse the product orange beverage with ordinary undiluted orange juice. In determining this question, the labeling of the product and all of the circum-

stances of its retail sale would have to be considered. "If the government would go further," said the Court, "it must undertake the formulation of standards of identity in this area."

There is some speculation as to whether this decision may not stimulate and accelerate interest in standards of identity for citrus juices. Logically, there will be considerable difficulty in establishing standards of identity for these noncarbonated, orange-flavored, soft drinks—which the Court noted have enjoyed considerable public acceptance—and for which there exists a substantial market—unless the FDA first establishes identity standards for both single-strength and concentrated citrus juices. Once again, experience suggests that there are difficult technical problems in this area.

Time does not permit discussion of the now-famous *Jam* case decided by the United States Supreme Court last March, which held that a product labeled and sold as imitation jam did not have to conform to the standard of identity for jam. This case has excited wide comment, much of which, in my view, is extreme. Both the legal and economic issues were examined by some of us at the Food Law Section of the American Bar Association last September, and these papers, some of which make lively reading, appear in the current issue of the *Food Drug Cosmetic Law Journal*. Those of you who are called upon to consider the inclusion of new or different ingredients in a standardized product—where your management is not unwilling to employ the imitation label—may be interested in reading those papers.

With your permission, I should like to turn now to an intriguing new development. Quickly to pose it in a proper setting requires some legal didacticism. The Federal Food, Drug and Cosmetic Act prohibits the shipment of any "article" that is misbranded or adulterated. "Article" can mean a lot, a carload, or even an entire shipload. Legally, the FDA can seize the entire shipment—irrespective of its size. In practice, it seizes the smallest lot that it can feel certain comprehends all questionable goods. If one finds mixed or overlapping codes, or goods physically scrambled in storage, the "article" may be the entire shipment or quantity stored, and the canner is given the burden, after seizure and publicity, of attempting segregation.

Obviously, with canned foods, inspection destroys the product cut and examined. Early in the administration of the 1906 Act, it was recognized that an entire shipment could be seized on the basis of inspecting a sample. A general rule of thumb was developed—the sample had to be taken at random and had to be reasonably representative of the lot. The courts concluded that whether a sample was big enough to be representative was a question of fact. In one case, 180 gallon cans were condemned by analysis of but one can; in another, some 2,000 cases of salmon were condemned by looking at 384 samples.

Often the size of the sample and the method of taking it turned on the nature of the charge. If filth or decomposition were involved, a small number of samples was considered enough. The inspection manual directed that one can be taken from a case, and that enough cases at random be opened to equal the square root of the total number of cases involved. On the other hand, where economic violations, such as short weight or slack fill, were concerned, a larger sample was considered necessary. In general, the FDA took the kind of sample which it believed would support court action. But, as one scholar has observed, the courts seemed "willing to condemn entire shipments on the basis of evidence which no statistician would regard as satisfactory." (Kennedy, "Sampling by the Food and Drug Administration," 6 *Food Drug Cosmetic Law Journal* (1951) 759.)

With the development of food standards under the 1938 Act, almost the first question that arose was whether the requirements were to be developed against what might be found as an *average* within a given code mark or portion of the pack, or were to be requirements that every single can produced had to meet. It is unnecessary for me to delineate before this group the wide variations that occur in raw materials, or within the range of workmanship that is encompassed within good manufacturing practices, or in the handling by the high-speed machinery that is necessary in seasonal canning operations.

At the outset, the FDA adopted the theory that food standards had to read on, and that their enforcement would be based upon, measuring each *individual can* against the prescribed standard. The argument was that these standards were designed for consumer protection—and that one consumer who got a product that did not precisely comply with the standard would hardly be consoled by the knowledge that another might have done better because the average of the entire lot met the standard.

Of course, this assumed that the identity differences, or the line betwen standard and substandard, or between a proper and a slack fill, were always an easily discernible absolute, rather than a matter of degree dependent upon good manufacturing practices, and other factors that controlled the basic requirement of the law that every standard has to be *reasonable*. Another argument was that unless the rules applied on an individual can basis, an unscrupulous packer might mix in a particular shipment cans that were measurably deficient. Assuming that this were economically possible, it was theoretically feasible to meet an average requirement by manipulating wide variables in particular cans.

Admittedly, the FDA theory was more a legal concept than an operating rule. It did not reflect enforcement policy. The Administration never made seizures for standard violation on the basis of a single can sample. It always took enough to meet the vague concept of a representative sample, and often in cases of doubt took additional and expanded samples. Nevertheless, the applicable rule for standard making was that each and every can in any lot had to meet the standard.

In formulating identity and quality standards, lip service was paid to the theory but reasonable results were nevertheless obtained. For example, the required Brix was usually stated in terms of a range. Variations in raw material were recognized in the use of such vaguely specific terms as "immature" or "succulent" without attempted mathematical measurement. In quality standards, the factors were usually expressed within limits—which is a simple way of expressing a tolerance—or the prescribed test permitted the use of a large sample embracing many cans.

Yet in the attempted development of standards of fill of container, there was rigid adherence to the single container concept. I am satisfied that in large measure the negligible number of fill standards that has been achieved is largely attributable to this fundamental difficulty. For in attempting to achieve a prescribed fill of container, the inherent variables operate most acutely if one must stake compliance against a single can.

In large measure the resulting difficulties are commonplace to this group. Even with small discrete units like peas, a simple measurement like headspace cannot be applied without recognizing that peas shake down after processing and standing. Some vegetables absorb water in processing; others lose it or bleed. Differences are encountered in the same product between brine and vacuum packing. Variances in specific gravity exist according to maturity or to areas in which grown; and differences in porosity or other physical characteristics control the amount of liquid pickup. It is easy to talk theoretically about volumetric measurement, or drained weight, or water capacity—it is an almost impossible job to prescribe a meaningful yet reasonable level which will operate in all areas and from season to season *on every can*.

Our work on corn, peas, pineapple, and other fruits has also disclosed that irregular sizes and shapes result in wide variations in fill. Most important, it has been discovered that there are limitations on the degree of

uniformity of fill in any machine operation. There are variations in the volume delivered from different pockets of a filling machine, and even from the same pocket from time to time. Unless high speed production is to be sacrificed, or excessive spillage and waste of raw material accepted, the best manufacturing techniques cannot guarantee to precise limits what the fill will be in every single can.

For some years, N.C.A. has attempted to obtain the adoption by the FDA for fill of container standards of a realistic averaging technique. Necessarily, this has required some basic thinking as to what constitutes an adequate sample on which to build a standard, and how that sample is to be statistically treated to evolve reasonable fill requirements. As a corollary, any regulation so developed ought to prescribe the size of the sample on which enforcement will be based.

The FDA has not been unreceptive. It hardly could be in view of its own administrative history. As early as 1912, prior to the attempted development of food standards, the general administrative concepts of fill of container were based on *averages*—with the requirement that variations occur as often above as below the agreed weight. (S.R.A. 1, Feb. 19, 1914.) Likewise, with respect to declared label weights the regulations recognized that the average might be used because of unavoidable deviations which occur in good packing practice. Logically, if an *average* could be used for testing the declared label weight of the contents, it seemed reasonable that no tighter standards should be used in determining the actual fill of the fruit or vegetable on a drained weight or volumetric basis.

By this time, those of you familiar with the recent development of statistical theory and methods and their application to sampling and inspection in manufacturing performance, in quality control, and in other areas, will recognize familiar patterns. The average idea is of course the arithmetic mean, necessarily of an adequate sample of the population. The notion of having as many deviations above or below a given level is the median. The adequacy of the sample and the chances of marked deviations occurring within the entire population should yield to formulas for standard deviations and statistical theorems about probabilities. No curve reflecting canned food fills looks normal, but patterns are discernible.

Much of the modern world's work is being done with the aid of these new statistical tools. As Professor Brown has pointed out in the *Harvard Business Review*, statistical quality control is being widely adopted in the manufacture of many products, and statistical techniques in determining whether shipments meet specifications are being employed by the military and by many industrial concerns. (Brown, "Quality Control", 24 *Harvard Business Review* (1951) 69.) H. G. Wells once remarked that statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write.

I am happy to report that the opportunity has now presented itself for the attempted application of these theories by competent people to the fill of container problem. In a measure, the FDA has recognized this need. It has expert personnel working on this job. In turn, the industry effort to develop standards of fill for pineapple —where a relative abundance of data is available and an interested canner group is hard at work—has reawakened interest in this challenging task of putting both formulation and enforcement of fill standards on a realistic and sound statistical basis.

Many of us believe that this activity offers great promise, and that out of it may come better techniques for developing reasonable fill standards that will not only protect the consumer but also reasonably recognize these unavoidable and uncontrollable variations.

I have ventured to burden you with this report because each of you will readily perceive that the successful employment of statistical methods requires an abundance of data upon which the statisticians can operate. When the time comes to formulate fill of container standards for any product in which you are interested, your responsibility to your managements will require that you have available in workable form complete records of your own operations. Only by having them can you insure that the standards evolved are well grounded and also be in a position adequately to measure their impact against the operations of your own company.

If any of you desire details as to methods or the desirable ways of recording information, the laboratory staff of the N.C.A. is ready and willing to assist you. For like the lady in the bomb shelter, to whom I first referred, despite the demands of the defense program, they are always at work at the continuing task they share with each of you in developing better canned foods.

APPENDIX A

Foods for which Standards Have Been Established under the Federal Food, Drug, and Cosmetic Act

(Included in Code of Federal Regulations)
(Compiled January 7, 1952)

[Unless otherwise indicated, standards are for identity only. Letters Q and/or F indicate that standards of quality and fill of container have also been issued.]

PART 14—CACAO PRODUCTS

Sec. 14.1-14.12, covering 12 products.

PART 15—CEREAL FLOURS AND RELATED PRODUCTS

Sec. 15.00-15.514, covering 31 products.

PART 16—ALIMENTARY PASTES

Sec. 16.1-16.10, covering 10 products.

PART 18—MILK AND CREAM

Sec. 18.500-18.540, covering 10 products.

PART 19—CHEESES; PROCESSED CHEESES; CHEESE FOODS; CHEESE SPREADS; AND RELATED FOODS

Sec. 19.500-19.788, covering 60 products.

PART 25—DRESSINGS FOR FOOD

Sec. 25.1-25.3, covering 3 products.

PART 27—CANNED FRUITS

27.0 Canned peaches. (Q and F)
27.3 Canned peaches with rum.
27.10 Canned apricots. (Q and F)
27.13 Canned apricots with rum.
27.20 Canned pears. (Q and F)
27.23 Canned pears with rum.
27.30 Canned cherries. (Q and F)
27.33 Canned cherries with rum.
27.40 Canned fruit cocktail. (Q and F)

PART 29—FRUIT PRESERVES AND JELLIES

29.0 Preserves, jams.
29.5 Fruit jelly.

PART 30—FRUIT BUTTERS

30.0 Fruit butter.

PART 36—SHELLFISH (IDENTITY AND FILL)

36.3 Canned wet pack shrimp and canned dry pack shrimp in nontransparent containers. (Fill of container only)
36.5 Canned oysters. (Q and F)
36.10 Oysters, raw oysters, shucked oysters.
36.11 Extra large oysters, oysters counts (or plants).
36.12 Large oysters, oysters extra selects.
36.13 Medium oysters, oysters selects.
36.14 Small oysters, oysters standards.
36.15 Very small oysters.
36.16 Olympia oysters.
36.17 Pacific oysters size 5 to 8 per pint.
36.18 Pacific oysters size 8 to 10 per pint.
36.19 Pacific oysters size 10 to 12 per pint.
36.20 Pacific oysters size 12 to 15 per pint.
36.21 Pacific oysters size 15 to 18 per pint.
36.22 Pacific oysters size over 18 per pint.

PART 42—EGGS AND EGG PRODUCTS

42.0 Eggs.
42.10 Liquid eggs, liquid whole eggs.
42.20 Frozen eggs, frozen whole eggs.

PART 42—EGGS AND EGG PRODUCTS

Sec. 42.0-42.60, covering 7 products.

PART 45—OLEOMARGARINE

Sec. 45.0, one product.

PART 51—CANNED VEGETABLES

51.0 Canned peas. (Q and F)
51.10 Canned green beans. (Q and F)
51.15 Canned wax beans. (Q and F)
51.20 Canned sweet corn. (Q and F)

PART 52—CANNED VEGETABLES (OTHER THAN THOSE SPECIFICALLY REGULATED)

52.990 Canned vegetables.

Artichokes
Asparagus
Bean sprouts
Shelled beans
Lima beans or butter beans
Beets
Beet greens
Broccoli
Brussels sprouts
Cabbage
Carrots
Cauliflower
Celery
Collards
Dandelion greens
Kale
Mushrooms
Mustard greens
Okra
Onions
Parsnips
Black-eye peas or black-eyed peas
Field peas
Green sweet peppers
Red sweet peppers
Pimientos or pimentos
Potatoes
Sweetpotatoes
Rutabagas
Salsify
Spinach
Swiss chard
Truffles
Turnip greens
Turnips

PART 53—TOMATO PRODUCTS

53.0 Tomato juice.
53.5 Yellow tomato juice.
53.10 Catsup, ketchup.
53.20 Tomato puree, tomato pulp.
53.30 Tomato paste.
53.40 Canned tomatoes. (Q and F)

Note: In many instances more than one common or usual name is specified for a particular food. In this listing most alternative names have been omitted.

Note: While the standard for butter and the standard for dry milk solids are included in the above list, these standards are prescribed by statute and are made an integral part of the Federal Food, Drug, and Cosmetic Act (21 U.S.C., Secs. 321a, 321c).

The Food and Drug Administration also enforces the Tea Importation Act which authorizes the establishment of standards for all teas imported into the United States. See, 21 U.S.C., Sec. 41 *et seq.*

APPENDIX B

STATUS OF COMPLETED OR PENDING FOOD STANDARDS NOT AS YET INCLUDED IN THE CODE OF FEDERAL REGULATIONS

(January 7, 1952)

Part 17—Bakery Products: Under this part Identity standards have been published in tentative form but not yet in final form for white bread, enriched bread, milk bread, raisin bread, whole wheat bread, etc. (15 F.R. 5102; 8 Aug. 1950)

Part 18—§ 18.520 Evaporated Milk; Identity has been amended in re vitamin D and the amendment is now effective. (16 F.R. 7819; 9 Aug. 1951)

Part 19—§ 19.782 Cream Cheese with Other Foods; Identity and § 19.783 Neufchatel Cheese with Other Foods; Identity have been issued in final form and are now effective. (16 F.R. 1632; 16 Feb. 1951)

Part 20—Ice Cream and Frozen Desserts: A hearing is in progress to establish Identity standards for ice cream, frozen custard, sherbet, water ices, and related foods. (15 F.R. 5112; 8 Aug. 1950)

Canned Pineapple and Pineapple Juice (no part number assigned): A hearing has been held and a tentative order has not yet been issued for Identity, Quality, and Fill of Container standards for canned pineapple and for canned pineapple juice. (16 F.R. 8743; 29 Aug. 1951)

Part 29—§ 29.0 Preserves; Identity, and § 29.5 Fruit Jelly; Identity: A tentative order proposing amendments of these two standards has been published and the final order has not yet been published. (16 F.R. 7070; 20 July 1951)

Part 30—§ 30.0 Fruit Butter; Identity: A tentative order proposing to amend this standard has been published and the final order has not yet been published. (16 F.R. 7070; 20 July 1951)

Part 32—Frozen Fruit: Under this part number proposed Identity and Fill of Container standards have been published in tentative form for frozen fruit in bulk containers and for frozen fruit in household-size containers, but the final order has not yet been published. (15 F.R. 6674; 4 Oct. 1950)

Part 45—§ 45.0 Oleomargarine; Identity: A tentative order proposing amendments has been published and the final order has not yet been published. (16 F.R. 10492; 13 Oct. 1951)

Part 51—§ 51.20 Canned Sweet Corn; Identity, § 51.21 Canned Sweet Corn; Quality, § 51.22 Canned Sweet Corn; Fill of Container, § 51.30 Canned Field Corn; Identity and § 51.32 Canned Field Corn; Fill of Container: Standards have been published in final form and are now effective. (16 F.R. 7644; 4 Aug. 1951)

Part 52—§ 52.10 Canned Mushrooms: A tentative order has been published proposing to amend the Identity standard for canned mushrooms and to establish a Fill of Container standard for canned mushrooms. The final order has not yet been published. (16 F.R. 1797; 24 Feb. 1951)

Part 53—§ 53.40 Canned Tomatoes; Identity: A final order amending this standard has been published but the effective date has not yet been reached. (16 F.R. 12763; 20 Dec. 1951)

Canned Meats for the Armed Forces

By K. T. Swartz and B. W. Gardner, Jr., Quartermaster Food and Container Institute

The importance of canned meats in the solving of armed forces' feeding problems cannot be overemphasized. This is particularly true when the feeding must be accomplished in active combat situations. As a matter of fact, canned meats constitute the only form in which this food is immediately available for consumption in conditions of active combat. Canned meats, however, exhibit certain deficiencies. The heat processing which is necessary, using current techniques, to make the meat stable for military conditions of use alters the original acceptability of the meat and may modify some of its nutritive qualities. The heat treatment given the canned meat to accomplish stability generally causes the development of inferior flavor and a soft, mushy texture. One of the major problems facing the canned meat industry is the development of processing techniques which will minimize these changes.

The deficiencies of canned meats used in combat rations have sometimes been emphasized by the frequent re-use of the same item. Monotony has frequently been the result. In order to minimize monotony and to provide variety, the Quartermaster Food and Container Institute has undertaken, with the help of industry, to develop new canned meat products and to improve the currently available ones. In the course of this program, the products received from industrial sources, as well as our own laboratory efforts, were screened by Institute technologists and representatives from the armed forces, and were evaluated on the basis of color, odor, general appearance, texture, flavor, and military characteristics. If a product passed the screening

test, it was subject to what is called "acceptance testing." If the product rated sufficiently high on the acceptance scale, the manufacturer or source was requested to supply information so that a specification for the product could be prepared. In the course of this study approximately 65 products were examined in the past year, and out of this number approximately 20 have shown considerable promise and are being investigated further.

Improvements in Existing Products

During the past year, considerable attention has been directed, in the Institute Laboratory, to the improvement of the currently specified products. Twelve canned meat ration products were modified so as to improve them. Probably the most significant example of this was the case of pork and gravy. Because of numerous reports to the effect that this product was excessively greasy, action was taken to determine what could be done to minimize the undesirable greasiness. By trimming more fat from the meat, prior to canning, it was found that the product was made decidedly more acceptable. Current procurements require the closer trim, and to assure the following of this more stringent requirement, a maximum analytical fat content has been established.

The product, beef and gravy, having faults similar to pork and gravy, but not to as great an extent, was also improved by closer trimming and a reduction in the fat content. In the product meat and noodles some difficulty had been experienced with the noodles matting and becoming excessively broken in preparation for canning. By requiring the use of 10 per cent added whole egg solids, instead of permitting egg yolk solids only, a great improvement in the texture of the noodle component was accomplished. The product chicken and vegetables was improved by deleting rice from the formula, substituting potatoes, increasing the chicken content and allowing a slightly higher moisture content.

Current Research

While the development of new canned meat products and the improvement of currently available products are desirable, yet accomplishments along these lines must be considered as temporary measures only. The ultimate in canned meats cannot be expected until more information of a fundamental nature is available. The Quartermaster Food and Container Institute is attempting to gain this information both through research at the Institute and through research contracts. Information is sought concerning the relationship of physical factors and the mode of heat transfer during the processing operations. It has become fairly well established that, in general, the use of high-temperature, short-time processes is advantageous in accomplishing spore destruction with a minimum of flavor or other quality changes. This assumes, of course, rapid come-up and cooling periods. The use of an agitating retort would appear desirable in applying short-time, high temperature processes to liquid or semi-liquid products in rigid containers. The Institute proposes to investigate this method of processing of those canned meats to which the technique would appear to apply. Additional information involving the mode of heat transfer in canned meats is being obtained through research contracts. One of these contracts has shown that with a solid piece of beef in the can, isothermal curves in the vertical plane tend to change from approximately cylindrical to approximately ellipsoidal in shape. Deviations along the central axis suggest a cardioid temperature distribution of some isothermals. Isochronals exhibit characteristics similar to those of the isothermals. With reference to canned meats in general, the effects of formulation variations and piece size will be determined.

Information is also needed concerning the microbiological characteristics of the food being processed. Data concerning the levels and types of bacterial contamination are needed. Some information along this line has been obtained through research contracts. While pork is the only meat that was investigated to any great extent, yet it has been found that the level of contamination by thermophilic anaerobes is extremely low, from 1 to 10 spores per gram. Usually, putrefactive anaerobes are considered the major causative factor of spoilage of canned meats. Representatives of this group have very high thermal resistances; two of the highest which might possibly be encountered are Putrefactive Anaerobe 3679 and *Clostridium sporogenes*.

In the case of Putrefactive Anaerobe 3679 the thermal process to destroy very *low numbers* of spores is relatively very high—1½ to 3 minutes at 250°F. In the case of some other putrefactive anaerobes it is very much lower. In the absence of putrefactive anaerobes of high thermal resistance, the required thermal process to reach sterility should be quite low—as low as F_s 0.2 is required for sterility. Unpublished data indicate that the thermal resistance of aerobic or facultative anaerobic spore formers suspended in meat is much higher than the values recorded in the literature as maximum for these types of organisms. Thus, it is becoming apparent that putrefactive anaerobes alone are not the limiting factor in determining minimum processes for producing sterile canned meats. There is another complicating factor. Although there is good evidence that spores of the most heat-resistant anaerobes do not germinate in properly processed cured canned meat products even on long incubation, recent unpublished work shows that spores of facultative aerobes (micro-aerophiles) can and do germinate in cured canned meat products processed to values insufficient to destroy all such spores present. This brings up a new consideration in safe processing levels for stable cured canned meat products. In fact, it appears to present a barrier to lower levels of safe stable heat processing of cured meat at this time. Thus, the industry program of recent years has resulted in improved sanitation and more rigid temperature control. These improvements have made possible changes in the processes required to reach sterility in cured canned meat products; this does not mean that additional lowering of processes is indicated or safe, at least until further technological improvements can be made. The reason is that putrefactive anaerobes are not the only hazard and that other organisms normally present may become the limiting factors for safe operation.

Studies are under way to determine the physical and chemical factors as related to the sporulation and germination of the spoilage organisms found in meat.

It should become apparent that if new processes are to be evolved which will yield the best possible canned products, it will be necessary to coordinate heat transfer information with that relative to the microbiological characteristics of the food under consideration.

New Techniques

New techniques for accomplishing the stabilization of canned meats are being investigated through research contracts. The use of dielectric heating for the rapid heating of finely comminuted meat in a continuous operation as well as fairly large pieces of meat in cans is being investigated. Also, the use of cathode rays for accomplishing product stability is being followed with interest at the Institute.

In conclusion, I should like to state that the Quartermaster Food and Container Institute is deeply appreciative to the canning industry for the assistance given from time to time.

Industrial Use of Fission Products from the Atomic Energy Program

By J. H. Hayner,
Division of Engineering,
Atomic Energy Commission

This is a welcome and timely opportunity for a discussion of the industrial utilization of fission products. I should like particularly to call your attention to the planning and philosophy of operation involved in the program of helping industry find uses for these new materials.

We, in the Atomic Energy Commission, are very appreciative of the invitation to outline for you the program of research and development, the fruition of which, in part, depends upon the reception and cooperation given by your industry.

As members of the National Canners Association and representatives of the individual companies, you are a major segment of the food processing and similar allied industrial operations. It so happens that these operations contain the potentiality of beneficial application of the power to be obtained from radioactive materials (fission products). To establish these benefits will not be a simple or easy undertaking, and practical economical results may not be obtainable, but advance of technology dictates that an attempt be made to explore fully the possibilities of any such application.

This exploration forms the basis of the present research and development program. As originally planned, we tended to shy away from the problems connected with food preservation and other products designed for human consumption and use, recognizing the many pitfalls that are present. The thought instead was to develop a firm knowledge in the technique of handling these sources of radioactive power, their proper design and geometry in any process development, and an investigation of the fundamental effects in physical and chemical reactions. But public opinion and active interest of your industry indicated an immediate need of learning what can be expected in that area of research. After all, cold sterilization and pasteurization by radiation may induce physical and chemical reactions so why not study them, while still looking at the production of ammonia, heuzene and polymers. A few more problems of technological development do not, per se, make them insurmountable providing one has the recognized experts employed in the research and this is where your cooperation is earnestly solicited. More about that later, but first let us take a look at what has been done.

In the original planning of this program there was a recognition of the need to seek early advice from industry and identify the various problems from its point of view, including likely areas of feasible research. A techno-economical survey was made of the opinion from a selected and representative management in a representative cross section sample of industry.

I am sure that those of you who were present at the dedication of your laboratory in Berkeley, Calif., will remember the remarks of Paul M. Cook, one of the team from Stanford Research Institute which conducted this techno-economic survey for the Atomic Energy Commission. The report of the Institute's findings is now available (there are several copies for distribution here to interested parties) and while addressed specifically to the Commission, it covers technical, engineering and economic considerations and discusses a variety of possible industrial uses for fission products. This information will be of interest and value to industry, and consequently, the Commission has authorized making the report available for the use of industry. While some of you are already familiar with its contents, the significance of certain aspects will be further explained.

The specific objectives of this study were designated by the Commission as follows:

Do radioactive fission products have potential large-scale industrial uses?

What is the estimated size (i.e., order of magnitude) of any potential industrial market for fission products?

What major problems confront the Commission in connection with the possible large scale use of fission products?

What research and development programs should be undertaken to encourage industrial uses for large quantities of fission products?

As you can appreciate, the answers to these objectives would give a picture which might satisfy every interest concerned with this evolutionary technology, but time is too limited here to discuss all the findings and information brought out in the report. Moreover, it is believed that your prime interest is directed toward the first and last objectives; consequently, they will be examined in some pertinent detail.

The first objective mentioned above was:

Do radioactive fission products have potential large-scale industrial uses?

The answer as recorded in the Stanford report is: "A potential large-scale industrial demand does exist for radioactive fission products. The full development of this market will be delayed a few years while solutions are worked out to the many technical and economic problems known to exist."

The information was developed that perhaps the largest single potential demand for a confined radiation source is in the field of cold sterilization, and specifically in food processing; for example, canned hams and peas. This statement is made with a considerable amount of reservation and I can see questions already forming, but lets not approach the problem with a defeatist attitude of "it can't be done," but rather one of trying to find out what has to be done to make it work successfully. We all recognize the long and arduous path of research and development which will have to be followed before the many necessary answers are obtained. Firm experimental evidence will have to be secured to determine the effect on products, development of toxins and chemical side-effects, to satisfy regulatory requirements and ultimately the customer. I am certain that in 1941 and 1943 when there were a great many more apparently insurmountable problems facing us in the production of the bomb, not much sympathy was given to the defeatist philosophy. So today, we recognize the gleam of a possibility in the present development and propose to do something constructive about it.

This leads us to the last objective as stated:

What research and development program should be undertaken to encourage industrial use of large quantities of fission products?

Again quoting from the Stanford report, the answer is "The research programs associated with the processing, preparation and shipment to industry of fission products should logically be handled by the Commission, at least for the present. In the interest of stimulating rapid development of a large market, the Commission may find it expedient to assist with applied development programs for a time. Ultimately, however, the research programs associated with the development of particular industrial uses for fission products should be supported by industry alone. The Commission and industry have already undertaken certain preliminary research activities that are essential to the achievement of large scale uses for fission products."

It might be advisable, before going into details of the research and development program, to review some of the historical and technical background.

The materials known as fission products consist of a group of isotopes within the atomic weight range of 72 to 162 which result from the fissioning (splitting) of Uranium 235 by a neutron absorption. They retain a portion of the energy of fission and release this energy by radioactive decay. Any potential large scale market that may exist for fission products

will result from a demand for the radiation energy present, rather than for other physical or chemical properties of the material.

Since 1944, the operations of the Atomic Energy Commission have been producing large quantities of these radioactive fission products, by-products of the operation of nuclear reactors or atomic piles. After recovery by chemical processing of plutonium and uranium from the depleted fuel of nuclear reactors, there remains a considerable volume of liquid aqueous wastes containing the fission products and other contaminants. This crude heterogeneous mass with only water removed is defined as gross fission products and would be the raw material for industrial utilization. These materials will become available in the near future with considerable volume (millions of gallons and curies). Up to now, they have been stored in underground tanks as part of the war born expediency and until adequate technology for processing was developed. New reactors will increasingly augment the supply.

In the meantime, to provide an opportunity for scanning experiments to locate and define feasible process applications, one of the National Laboratories (Brookhaven) has prepared mock radiation sources employing various isotopes such as Cobalt 60 and Tantalum 182. You will hear more about these materials and details of experimentation in a following report by Bernard Manowitz of the Brookhaven National Laboratory, who directs the local program.

From a planning point of view, there appears to be three major categories of problems to be solved. All are interdependent and certain phases overlap, but they can be defined as:

(a) Preparation of the fission products in a form suitable for industrial process applications.

(b) Development of the technological basis for various potential uses.

(c) Determination of a distribution program and inherent policy, before making fission products available to qualified industrial users.

In the case of category (a), it can be dismissed by saying that agreement is reached with the finding of the Stanford survey that the processing, preparation and shipments to industry of fission products can best be handled by the Commission, at least for the present. This conclusion arises from the fact that the Commission and its contractors possess a monopoly of experience in the handling of large amounts of radioactivity. Furthermore, the Commission is in the best position to integrate plans for processing fission products into other plans affecting the atomic energy program. After the basic technology is established, the desirability of calling upon private industry to perform part or all of the functions of extraction, separation, packaging, and distribution of fission products can be considered. In passing, however, it might be noted that there are surveys underway by two different industrial organizations exploring the possibilities of carrying out these operations in private industrial facilities.

Before going into category (b), which constitutes the major emphasis of this research and development program, we can consider category (c).

Determining how fission products are to be distributed to industrial users is primarily an internal problem and it appears to be premature for discussion at this time. The assumption can be made that in the main it would follow the pattern already established in the Isotopes Distribution, the regulations of which are a matter of record in the *Federal Register*. Actually, there are fission products now available from Oak Ridge by this procurement, although not in the quantity or level of activity with which we are concerned. When the time comes, if we are successful in developing applications, there is no doubt that a mutually satisfactory arrangement can be worked out.

Now let us look at the work being done to satisfy category (b), the development of technological basis. Here again, you will find agreement with the results of the survey in that, for the interest of stimulating rapid development of a large market for fission products, the Commission does find it expedient to assist with applied development programs for a time.

Following discussion with representatives of industry, research laboratories and institutes, universities and the national laboratories, the AEC determined that a program for developing possible uses of fission products should include the following phases:

(a) Acquainting industry with the known technical facts concerning the nature of the wastes available, stimulating interest in the potentialities of these radioactive materials, and defining with industry the more likely applications to be investigated.

(b) Establishing a limited research and development program sponsored by the AEC to provide basic technical information for general distribution and use.

(c) Encouraging industrial organizations to develop applications of fission products based on the radioactive characteristics of the material and to proceed with the commercial exploitation of these developments.

The first two phases of this program have been initiated and include various complementary projects as follows:

(a) As previously indicated, Stanford Research Institute at Stanford, California, has recently completed a final report that finds there are major potential industrial markets for kilocurie amounts of concentrated fission projects. This report points out the many technical and management problems that must be solved before this market can be achieved, and it encourages the AEC to seek solutions to these problems with the help of industry. The interim, informal reports of the Stanford team have been used as a guide in formulating the research and development programs described in the following paragraphs:

(b) The Brookhaven National Laboratory has been established as a central overall coordinating facility in the research and development program with primary functions as follows:

(1) To advise the AEC in evaluation of research proposals and to assist operating contractors as well as industry in the establishment of safe and operable experimentation with high level radioactive sources.

(2) To provide temporary interim high level (kilocurie) sources of isotopes irradiated in the BNL reactor (preliminary to availability of similar fission product sources).

(3) To provide an irradiation service at BNL for industry, utilizing kilocurie sources of gamma and beta emitters such as Cobalt 60, Tantalum 182 and Palladium 109.

(4) To stimulate and foster interest as well as advance the state of knowledge in certain experimental projects such as liquid polymerization.

(c) The University of Michigan has been authorized to establish a research and development program in selected projects of chemical and physical reactions based upon previous work performed by the University faculty in these fields. One project is the investigation of those chemical reactions which give promise of being catalyzed by the radiation from fission products. It is well known that electromagnetic radiation can interact with molecules and the atoms within molecules of matter, resulting in free ions, chemical radicals or activated molecules. Thus, it would seem very probable that some chemical reactions might be caused to proceed in the presence of the fission products. In the physical field, it is believed that ionizing radiations from gross fission products may be used to improve the explosive reactions in internal combustion and jet engines. This might be accomplished by (1) promoting more complete combustion of the gas mixture, (2) increasing and stabilizing the rate of flame propagation in explosive reactions, (3) increasing the efficiency of existing fuels, (4) permitting the use of fuels of lower octane rating in

gas engines, and (5) developing better diesel-engine performance. These latter projects are already of military significance.

(d) MIT and Columbia University—at each of these universities, in the Departments of Food Technology, there have been small projects established for studying the effects of radiations from gross fission products in the preservation of foodstuffs, pharmaceuticals, tissues and other biological substances. In order to permit the immediate start of experimental work, sources of Cobalt 60 (1.5 kilocuries) will be provided by BNL for each area. This will allow a scanning of the more feasible reactions providing experimental data for correlation with existing information secured from particle accelerators and x-rays and also will establish threshhold values for sterilization, pasteurization, or inactivation of enzymes, bacteria and other organisms. Of extreme interest is the feasibility of sterilizing the antibiotics, which are heat-sensitive and difficult to keep aseptic. The planning of the programs will allow application studies at both sites, with subsequent necessary analytical investigations to determine chemical side effects, any developed toxicity and harmful nutritive results. Likewise, a testing program of diet on live specimens will be necessary for at least two years to partially satisfy the requirements of the Food and Drug Administration.

(e) Yale and Columbia Universities—Two small projects have been established at these universities to explore the possible utilization by chemical means of the gamma radiations resulting from the radioactive decay of fission products. Although a large amount of work has been done in the field of radiation chemistry, very little information can be found on reactions of commercial interest. Furthermore, most of the work has been done with low level sources. For these projects, a high level (1-1.5 kilocurie) Cobalt 60 source has been obtained from BNL. The work at Yale would be restricted to an investigation of organic gas-phase reactions. Typical subjects for initial study are:

(1) Gas-phase polymerization of acetylene (desirable product would be benzene).

(2) Gas-phase polymerization of ethylene to polyethylene.

(3) Gas-phase oxidation of ethylene (the vapor phase hydration to ethyl alcohol would also be studied).

At Columbia there is a complementary project established to investigate the inorganic gas-phase reactions. Several reactions appear interesting for the initial study. These include the synthesis of ammonia from nitrogen and hydrogen and the production of cresols from toluene and water.

(f) General Electric Company—A project has been established with the General Engineering Laboratory of the G.E. Company. Such a project, under the existing contract to operate KAPL will have various objectives relating to the industrial utilization of fission products. A work program consisting of three phases has been established:

(1) Feasibility study (to be largely supplied by the report of the techno-economic study by Stanford Research Institute).

(2) Fission Products source development.

(3) Direct demonstration of the application of fission products sources for such purposes as:

(a) Sterilization of foods and drugs.

(b) Industrial radiography.

(c) Instrumentation.

The third phase of this over-all program, which is concerned with the encouragement of industrial organizations to develop applications of fission products and to proceed with the commercial exploitation of these developments, brings us to the point of inviting inquiry and cooperation from industrial organizations and associations such as the National Canners Association. There has been a considerable expression of interest from industry and in certain instances this has been followed by experimentation and identification of feasible process applications. Already progressive organizations have supported these small beginnings and will project them through pilot plant operations. It is hoped that before too long this participation will show a magnitude in dollars exceeding the million dollar program which the Atomic Energy Commission is contributing. Ultimately, industry should provide the major drive and financial support, especially in those fields of application which permit commercial exploitation, consistent with the profit motive.

We appreciate that the ideas are new, the materials are unique and novel and the whole subject very thought provoking. However, considerable education as well as practical results from experimentation will be necessary as progress is made, and in order to insure that this be immediate and in the greatest extent, there must be industrial cooperation.

Time will probably not permit answering in detail such questions as may occur to you now, and I am sure you will have more after further consideration of the problems.

So, in closing, let me leave this thought with you. The Atomic Energy Commission has initiated a planned research and development program directed toward the industrial utilization of fission products. The program I have outlined may not appear to be as comprehensive as you would like to see and you may have the impression that it seems to be inadequate to satisfy your need of experimental knowledge, yet we feel confident that it is an advance in the right direction. Your advice, technical judgment and good counsel are earnestly solicited. I want to assure you that any interest expressed to the Commission will be fully explored so that the maximum benefit may accrue to all.

Current Experimental Program on Fission Product Utilization

By B. Manowitz, Reactor Science and Engineering Dept., Brookhaven National Laboratory

During the past year a program has been under way to study the possibilities for the utilization of the radioactive wastes produced as by-products of plutonium production. One recalls that during the fission process U^{235} absorbs a neutron and explodes into fission fragments—the so-called fission products. The fission products constitute about 20 elements in the middle portion of the periodic table. They retain a portion of the energy of fission and release this energy by radioactive decay. The radioactive decay process involves the changing of one element to another by the emission of a beta particle. Beta emission often leaves an atom in an excited state which changes to a ground state by the emission of gamma rays. The isotope formed from the decay of another radioisotope is often itself radioactive and in turn decays by beta-gamma emission. It is this beta-gamma emission that may be ultimately industrially applicable.

The principal long-lived fission products have the characteristics listed in Table I.

It may be best at this point to define several terms which I will use later in my talk. Most important are the curie, the roentgen, or roentgen equivalent physical, and the mev. The curie is the term commonly used to describe amounts of radioactive material, although, strictly speaking, it is defined as a rate of decay of radioactivity. A curie is defined as a rate of radioactive decay equal to 3.7×10^{10} disintegrations per second. This rate is directly proportional to the amount of radioactive atoms present (the proportionality constant being the decay instant); hence the common misunderstanding. The de-

TABLE I

Characteristics of Significant Fission Products

Isotope	Symbol	Yield	Half-Life	Radiation Beta Energy–Mev	Radiation Gamma Energy–Mev
Strontium 90	Sr	5.3%	25 years	0.61	None
→ Yttrium 90	Y		62 hours	2.3	None
Yttrium 91	Y	5.4%	57 days	1.53	None
Zirconium 95	Zr	6.4%	65 days	0.39 (98%) 1.0 (2%)	0.73 (93%) 0.23 (93%) 0.92 (7%)
→ Columbium 95	Cb		35 days	0.15	0.76
Technetium 99	Te	6.2%	$1x10^5$ years	0.3	None
Ruthenium 106	Ru	0.5%	1 year	.03	None
→ Rhodium 106	Rh		30 seconds	3.5 (82%) 2.3 (18%)	0.51 (17%) 0.73 (17%) 1.2 (1%)
Cesium 137	Cs	6.2%	33 years	0.5 (95%) 1.19 (5%)	None
→ Barium 137	Ba		2.6 minutes	None	0.66
Cerium 144	Ce	5.3%	290 days	0.35	None
→ Praseodymium 144	Pr		17.5 minutes	3.0	0.2 1.2
Promethium 147	Pm	2.6%	4.4 years	0.22	None

cay instant can also be expressed in terms of the half-life of the material. The half-life is the time required for half of the original material to have decayed.

The radioactive material decays by the emission of gamma rays or beta particles, i.e., electromagnetic and fast electron radiation. The intensity of a radiation field is often expressed in roentgens. A roentgen is defined as the amount of ionization required to produce 1 esu of charge in 1 cc of air at STP. The REP is used when one is considering the absorption of radiation in media different from air. In absolute units the energy absorbed in material of density 1 equivalent to 1 R in air (REP) equals 94 ergs/gm.

A mev is the term used to describe the energy of the incident radiation and merely means a million electron volts. In order to orient the chemist, one electron volt equals about 23 kilocalories per mole.

The energy at which beta particles or gamma rays are emitted is a chief consideration, because penetration and ionization abilities are a function of energy. A more direct indication of the usefulness of radiation is radiation power or the product of the number of particles or photons emitted per second and the energy of each particle. Figure I represents the beta power of the principal fission products as a function of time after removal of fission products from a pile. The total beta power of mixed fission products decreases rapidly for the first six years with a half-life of about one year, and then is relatively constant at about 2 percent of the initial power. The usefulness of beta radiation is closely tied to its penetrating power. Betas are fast electrons. They interact with matter by electron atom collisions, and have a relatively short range. Their range in matter, and hence the energy absorption in matter, will be a function of the beta energy and the atomic number of the material through which they pass. Betas have a definite range in matter. The hardest beta will lose a major fraction of its energy in going through 80 inches of air or 0.15 inches of water, and the weak beta will lose most of its energy in 30 inches of air or 0.05 inches of water. The short penetration means that there are very limited applications for beta power, and that there will be difficulty in packaging beta activity in such a manner that a large fraction of the betas will get out of the container. On the other hand, the short range of the pure beta emitters reduces the safety hazard and provides the opportunity of most of the radiations being absorbed where they will do work. One would think that gas phase work holds the best possibility for the application of betas.

Note in Figure II that the total gamma power of mixed fission products decreases rapidly for the first six years with a half-life of about one year, and then is relatively constant at about 2 percent of the initial power. The pentrating power of gammas is much greater than that of betas. Gammas are absorbed exponentially in matter—the major mechanisms of the interaction of gammas in matter are the photoelectric effect (or a gamma-electron collision with complete energy transfer to the electron), and the Compton effect (a scattering effect whereby the gamma loses part of its energy at each electron collision). The photoelectric effect is predominant at low energy and is a function of Z^5, whereas the Compton scattering is important at energies of about .6—1.2 Mev, and is a function of Z. Above 1.02 Mev, pair production may occur; this ef-

FIGURE I

Beta Radiation Characteristics of Fission Products

Industrial Uses of Radioactive Fission Products, Stanford Research Institute, 1951

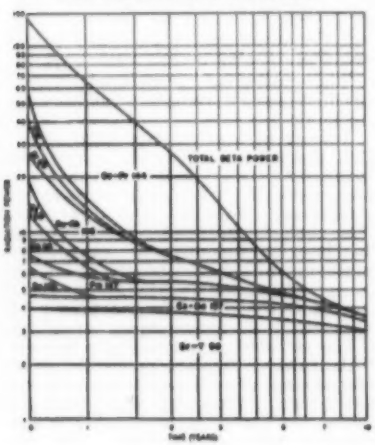
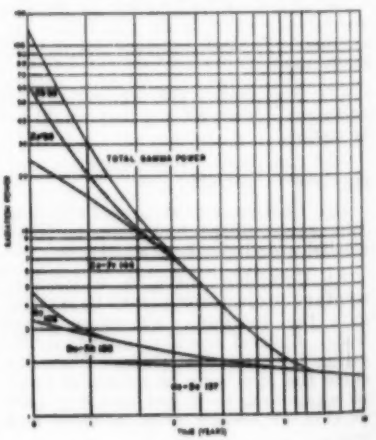


FIGURE II

Gamma Radiation Characteristics of Fission Products

Industrial Uses of Radioactive Fission Products, Stanford Research Institute, 1951



fect is not likely in the fission products since few fission products are that energetic. There is a 50 percent reduction of energy absorbed in about 4 to 6 inches of water. This suggests that a system of spatial constancy in medium of density 1 should consist of a lattice with 8 to 12 inch lattice parameter. Because of these greater penetrations of gamma power, one would think that there would be more commercial applications for gammas than for betas.

Ultimately, then, we hope to make use of beta and gamma radiations from fission products. Reactors of today and of the future will produce millions of curies of fission products per year, so that if a sufficient large-scale demand exists, an adequate supply seems assured. No really large-scale use of high-energy radiation is in evidence today, so that a research program on uses of intense fields of beta-gamma radiation is in order. To facilitate such a program, we have prepared simulated fission product radiation sources by pile irradiating cobalt and tantalum. These special sources will be used in three ways:

1. At Brookhaven National Laboratory in the laboratory's own investigations into application of the radiation.

2. At Brookhaven National Laboratory as irradiation services performed for non-AEC organizations interested in determining radiation effects on various materials.

3. At the laboratories of various AEC contractors where research on specific problems will be carried out.

Although the gross fission products emit both beta and gamma radiations, we have produced sources which are primarily gamma-emitters. They are Cobalt 60 with a half-life of 5.3 years, gammas of 1.33 and 1.17 Mev, and a thermal neutron absorption cross-section of 22 barns; and Tantalum 182 with a half-life of 117 days, gammas of 1.22, 1.13, 0.22 and 0.15 Mev, and a thermal neutron cross-section of 21 barns.

Co^{60} has the advantage of a long half-life; in comparison Ta^{182} has a short half-life, and will have to be returned to the pile every six months to be irradiated again. Despite this, however, it has the advantage of giving a higher specific gamma-flux.

The cobalt was cast and machined into a tubular shape. Two cobalt tubes—each about 6.6 in. in length, 2.2 in O.D., and 1.7 in I.D.—were placed end-on-end within two concentric aluminum tubes 13.5 in. long, 2.3 in. O.D. for the outer tube, and 1.5 in. I.D. for the inner tube. The ends of the tube were welded so that the Co and Al would be one unit. In a similar manner, the Tantalum, 0.060 inch thick, was rolled into tubular shape and inserted between aluminum tubes, the ends of which were also welded. The complete units were

FIGURE III

Cobalt and Tantalum Source

placed in the pile and irradiated for 60 days. We have calculated that the Cobalt should contain about 1000 curies of Co^{60} and the Tantalum about 2000 curies of Ta^{182}. The techniques of handling these sources are interesting in that they are indicative of the techniques that can be developed for handling fission product sources.

Figure III pictures a Cobalt and Tantalum source in the bottom of the canal under about 8 feet of water. The water provides enough shielding so that the radiation level at the surface of the water is about 2-3 mr per hour. The sources can be manipulated easily by long tongs. One method of using the radiation field is to insert the source into a stainless steel tube. A long aluminum test tube weighted on the bottom can be inserted through the source, and irradiation containers lowered into this well by a fishing pole (Figure IV). It is also possible to put a detecting instrument in the bottom of the aluminum test tube and use this system as a probe to determine isodose lines in water.

The intensity of these gamma sources is such that they have been photographed by the luminescense of the surrounding water. The glow is probably caused by Cherenkov radiation (electrons traveling faster than the speed of light in that medium).

The sources are placed in a lead receptacle, shown in Figure V, which is lowered into the canal. The cover and plug are put on the lead container under water and the entire affair is then lifted out of the canal. About seven inches of lead shielding reduce the radiation level at the surface of the pig to about 25 mr per hour for a 1,000-curie source.

Several sources in a group are provided with secondary concrete block shielding. When the sources are not in use, the retaining strap is locked in place, insuring that a curious passerby does not tamper with it.

The plug of the pig is fitted with an aluminum tube that serves to house experimental vials, or test tubes. The tube is connected by a quick opening lug-type connection. In practice, a test tube containing the material to be irradiated is slipped into the aluminum tube, which is then connected to a lead plug.

Figure VI shows a loaded tube and plug ready to be lowered into the source. When the plug is off the source, a collimated radiation beam comes out. The radiation level at the mouth of the source is about 10 R per hour. At the working area the radiation level is about 5-10 mr per hour. The intense beam of radiation extends for about 10-20 feet, so the sources are kept in an area where there is no possibility of personnel becoming exposed to the beam, i.e., a one-story building about 25 ft. high. The scattered radiation does not exceed 5 mr per hour in any working area of the room. A radiation alarm rings a bell whenever the plug is lifted. The lifting device is a simple pulley affair and can be used to service three sources.

Now let us consider some possible industrial applications for beta and gamma radiation. A good indication of the threshold of utility is the radiation dose required to produce an effect. To generalize, the dose required for chemical effects seems to be at least an order of magnitude greater than that for biological effects, and the dose for biological effects seems to be an inverse function of the complexity of the organism.

FIGURE V

Diagram of Receptacle for Source

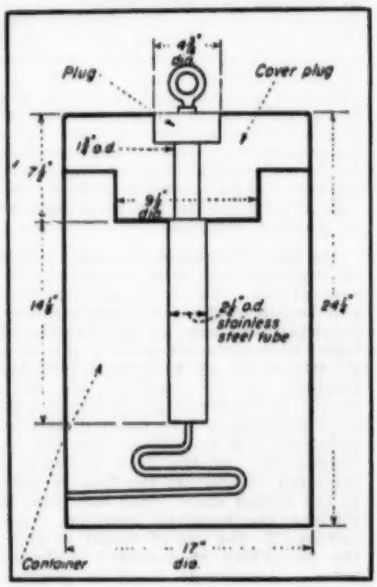


FIGURE IV

Inserting Material into Radiation Source

FIGURE VI

Loaded Tube and Plug Ready to be Lowered into the Source

Let us consider the initiation of chemical reactions by radiation.

The rate at which chemical reactions progress can be affected by heat, catalyst or radiation. Most industrial chemical reactions utilize heat or catalysts to achieve molecular excitation. Let us see what the relative advantages and disadvantages of radiation would be. One disadvantage would be the radiation energy input required to effect chemical reactions on a commercial scale. Rough calculations indicate that it would take many millions of curies to produce simple decomposition products on a tonnage-per-day basis. More promising is a chemical chain reaction which requires a small number of free radicals in relation to the total amount of product obtained.

On the other hand, the advantages of radiation-initiated reactions are several-fold. First of all, reactions can be initiated at low temperatures. Applications may be in systems of high thermodynamic yield at low temperatures, or in systems where the products of the reaction are heat-sensitive. Theoretically, it may be possible to produce free radicals at temperatures low enough so that the recombination of the free radicals is inhibited—transport the free radicals in the frozen state—then use them to initiate the required reaction. Advantage 2—the use of radiation poses the possibility of constant initiation rates. Advantage 3—it is possible to initiate reactions without the incorporation of chemical additives in the reaction mass. Advantage 4—the initiation can be external to the reactor vessel. Advantage 5—radiation creates an ionized field into which surface charges can leak.

We have studied the polymerization of several monomers at Brookhaven. We have found that it takes 3 million REP to polymerize methyl methacrylate, 3 million REP to polymerize vinyl acetate, and 35 million REP to polymerize styrene.

In the polymerization of styrene, percent converted is linear with dose up to 40 percent conversion; the curve starts from 0 and there is a sharp increase in percent conversion at 40 percent to 100 percent. We do not as yet claim to completely understand the kinetic picture such a curve is trying to describe to us. The linearity of the first portion of the curve indicates that the rate of polymerization is directly proportionate to ionization intensity; the slope indicates that it takes about 160 EV to produce an active center. The peaking effect may be due to a sudden decrease in termination rate. This may be due to an increase in viscosity in the region. At any rate, for the range of radiation doses required to produce polymerization, it would require millions of curies for a radiation reactor that would produce, say a ton of polymer per day. Obviously, then, radiation will not compete with the standard methods of polymerization.

Indeed, it is improbable that radiation will economically replace any standard initiation method used today for producing chemicals on a large scale, i.e., rubber or gasoline. However, there probably will be a commercial field for radiation wherever one can utilize the unique advantages of radiation, and where no very large amounts of total energy are required to produce something of high value.

Let us now consider biological systems. We have mentioned that the dose for biological effects seems to be an inverse function of the complexity of the organism. For instance, a dose of about 500 REP is lethal to man. Unfortunately, this has been the major use of radiation thus far. A dose of about 25,000 REP seems to be lethal to lesser organisms like insects.

Figure VII summarizes the work of Proctor and Goldblith at MIT and indicates the lethal dose of cathode rays for bacteria, yeasts, and molds. The dose required varies from ½ to 2 million REP. Work of other investigators has indicated that it takes at least ten times the dose required for sterilization to affect biological activity, nutrients, or enzyme systems, so that it would appear feasible to sterilize metabolic materials without destroying their metabolic activity. However, doses required for sterilization are in the range that may also

affect taste, color and texture. Thus, the chief disadvantage of applying radiation to biological systems is the complexity of the effect produced, and the need for extensive research to insure that the beneficial effects outweigh the detrimental ones. On the other hand, the advantages of radiation application are those that have already been noted for chemical system application—namely, low temperature usage, non-inclusion of contaminating additives, reaction rate control, and application of initiator external to reaction vessel, plus the fact that a much smaller amount of total energy is required for the same scale of application.

The most promising potential market for cold sterilization with gamma rays appears to be heat-sensitive drugs and pharmaceuticals. This is due to the high cost of present methods of assuring sterility in heat-sensitive materials, the improved certainty of sterilization by radiation, and the high value of the end products. The fact that the pharmaceutical industry has had a background of experience in research on sterilization with particle accelerators, and is willing and anxious to try this new source of radiation, will be a factor in its early application.

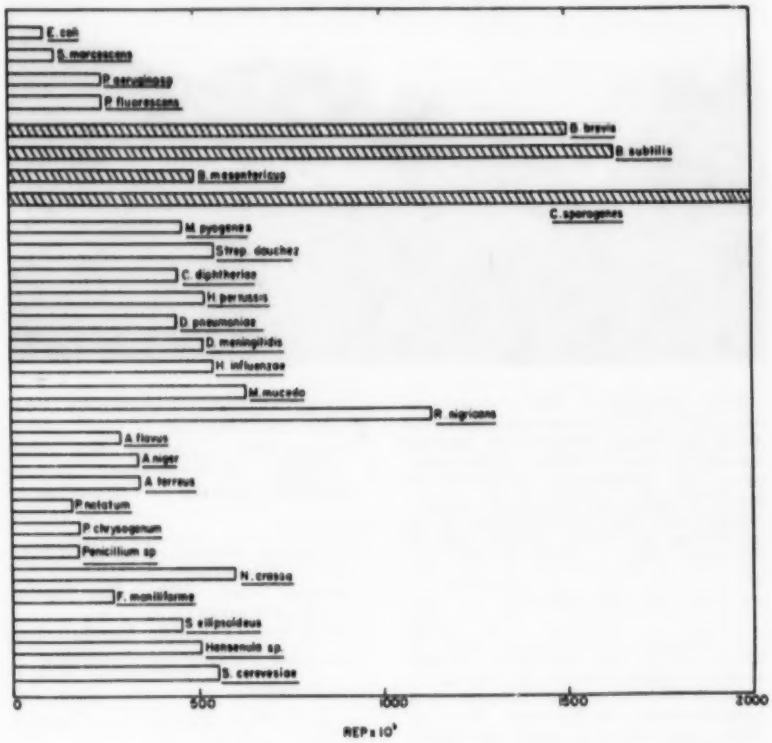
Food sterilization without heat offers many attractive potential markets, but here particular attention must be paid to the effects of radiation on enzymes, nutrients, flavors, colors, and textures. Possible avenues of approach are (1) the pasteurization rather than the sterilization of foods, and (2) the use of multiple agents for the sterilization with radiation assuming a supplementary role.

It is important to note that the entire effect of Fission Product Utilization is now very much in the embryonic stage. It takes many hours to perform sterilizations with present experimental sources, and it will take time for more intense sources to be developed. No fission product sources have yet been made. Ground work in fission product sources will take at least two years, and development work at least two years more. Even at that time only short-lived materials will be available in 100,000 to 1,000,000 curie lots. It will take five years more before cheap megacurie sources of long-lived fission products are available. On the other hand, facilities are being set up for the production of refined isotopes that should be able to deliver a million curies per year in about three years, and experimental sources of cobalt and tantalum are available in 1000-curie lots today.

Clearly the time prior to the production of megacurie fission product sources can best be made use of by an intense research effort. It is expected that this research effort will throw light on many possible applications of reactor waste products. If such uses are found to be extensive, and if the price of these products can be made low enough, our industrial technology will benefit, and part of the Atomic Energy Commission's waste problem will be solved.

FIGURE VII

Doses of Cathode Rays Lethal to Bacteria, Molds, and Yeasts. The bars with diagonal lines represent spore-forming bacteria



Spray Irrigation as a Means of Cannery Waste Disposal

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The use of spray or sprinkler irrigation for the watering of crops has been known to agriculturists for many years. That this system of applying water to land could be adapted to waste disposal has been recognized only recently. The disposal of cannery waste waters in such a manner as to completely avoid stream pollution has quite naturally led to methods involving disposal on or into soil. Soil disposal methods include: intermittent flooding onto porous soils; the "ridge and furrow" irrigation absorption system; absorption lagoons; retention of wastes in lagoons for a period of time sufficient to permit stabilization of the waste prior to ultimate discharge of the remaining waste; and finally, spray irrigation. Each of these systems has its own advantages and disadvantages.

For those not familiar with the equipment required in the agricultural sprinkler irrigation system and its adaptation to waste disposal, a brief description of the basic features involved is in order. Water or liquid waste is applied to the surface of the ground by means of a high-pressure sprinkler system. Usually, light weight aluminum or galvanized piping equipped with special couplings to permit rapid laying and moving of the pipe over the areas to be irrigated is used. An electric or gasoline pump delivers water under 35 to 100 pounds nozzle pressure to self-actuated re-

Disposal of Cannery Waste by Spray Irrigation

volving sprinklers. The objective in agricultural irrigation is to supply the minimum water required to produce maximum plant growth; in waste disposal the objective is to apply the maximum amount of waste water consistent with minimum damage to the prevailing vegetative growth and at the same time to avoid surface runoff.

First Use of Method

Historically, the first application of spray irrigation as a means of waste disposal appears to have been inaugurated in 1947 at the Hanover Canning Company at Hanover, Pa. (1). The operation of a combined lagoon and spray irrigation system which completely eliminated stream pollution at this plant apparently passed unnoticed. In 1949 Seabrook Farms in New Jersey investigated the possibilities of irrigation and in 1950 installed a spray irrigation system capable of handling their entire volume of waste (2). The year 1950 also witnessed the successful application of spray irrigation as a complete system of disposal at the Plainview, Minn., plant of the Lakeside Packing Company and its trial application at two other Minnesota plants (3). In addition to the above pioneering companies, there were 19 additional spray irrigation systems in operation during 1951.

A complete list, so far as known, of the spray irrigation systems in operation during 1951 is as follows:

Wisconsin:

- Baker Canning Co., Theresa (Disposal of part of lagooned cannery wastes only).
- Brownsville Canning Co., Huistiford
- Chilton Canning Co., St. Nazianz
- Clyman Canning Co., Clyman
- Country Gardens, Inc., Coleman
- Loyal Canning Co., Loyal
- Mammoth Spring Canning Co., Sussex and Oakfield
- Oconomowoc Canning Co., Sun Prairie and Waunakee
- Rockfield Canning Co., Granville

Minnesota:

- Fairmont Canning Co., Fairmont and Winnebago
- General Foods (Birds-Eye Snider Div.), Waseca
- Green Giant Co., Blue Earth
- Lakeside Packing Co., Plainview

New Jersey:

- Francis H. Leggett & Co., Landisville
- Seabrook Farms Co., Seabrook

Iowa:

- Green Giant Co., Garrison

Maryland:

- John H. Dulany & Son, Inc., Fruitland

Michigan:

- Michigan Fruit Canners, Inc., Fennville

Pennsylvania:

- Hanover Canning Co., Hanover (Disposal of lagooned cannery wastes only)

The adaptation of spray irrigation to waste disposal appears simple. Indeed, it has proven to be so at several canning plants, but these were small plants and the problems involved correspondingly small. Observations made at a number of installations show that while the system offers great promise as one method of disposal it is subject to limitations. Very definitely it is not a panacea for all liquid cannery waste disposal problems.

Before discussing the major considerations and problems which should serve as a basis for evaluating the possibilities of utilizing spray irrigation brief reference to the equipment or operation of the system at several plants will be made.

1. Seabrook Farms, Seabrook, N. J. The results obtained at this plant are by far the most spectacular. Processing of vegetables, principally for freezing, extends from spring to late fall. An average of about eight million gallons of waste waters are produced per day. Before discharge into a 2-mile open canal leading to the irrigation area suspended solids are removed by primary sedimentation. When necessary the wastes are chlorinated to prevent odor development in the canal. Waste is pumped from 1,100 gallon per minute electric pumps located along the canal and delivered to 54 large rotary sprinklers located in a second-growth oak-pine wooded area. Each sprinkler delivers a spray to irrigate one acre. Instead of moving pipe lines, the spray nozzles are moved along the laterals. Waste is applied from a sprinkler station for a period of 8 hours at the rate of one inch per hour. The nozzle is moved to the second station for an eight hour application, then to the third station, and finally returned to the first riser to repeat the cycle. A given area, therefore, receives 8 inches of waste per day for many consecutive days. This remarkable capacity for absorption is due primarily to a great depth of sandy soil of high permeability. However, the nature of the vegetative cover, in this case a wooded area, plays an important part in the rate of absorption.

2. Lakeside Packing Company, Plainview, Minn. The irrigation disposal system at this plant consisted of a 20-mesh rotary screen; a wet well constructed from a salvaged steel cooling tank and holding approximately 150,000 gallons; a vertical turbine pump unit powered by a 50 H.P. motor operated by a tape float control; approximately 6,400 feet of 7-inch aluminum piping for main feeder lines; and four portable aluminum lateral sprinkler lines, each consisting of 380 feet of 5-inch pipe and 600 feet of 4-inch pipe with each lateral carrying 25 3/16-inch x 7/32-inch sprinklers rated at 14.2 gallons per minute at 35 pounds nozzle pressure. An auxiliary 15 H.P. portable pump powered by a gas engine is available to irrigate from an emergency storage lagoon should temporary storage of waste be required. Of the crop land (peas, corn, alfalfa and timothy) available for irrigation 72 acres were used in 1950 and 128 acres in 1951. The topography of the land was rolling. The soil was a silt-loam underlain with clay. The estimated volume of waste disposal in 1950 was 16 million gallons from a combined pea and corn pack of 295,000 cases No. 2 equivalents. The rate of waste application varied depend-

ing upon the demands of the particular crop being irrigated.

3. Green Giant Company, Blue Earth, Minn. Irrigation was used at this plant during the 1951 corn pack to dispose of an average of 450,000 gallons per day on a heavy loam. A total of 22.5 acres of rolling land were irrigated of which 15 acres was pasture land and the balance wooded. Waste was applied at a rate of 2.5 to 3 inches per setting and the spray nozzles moved every 12 to 15 hours.

4. Mammoth Spring Canning Co., Oakfield, Wis. At this plant pea wastes are produced at a rate of approximately 100 g.p.m. A single lateral of 4 inch aluminum pipe 1,200 feet long equipped with 20 sprinklers spaced 60 feet apart, each sprinkler having 5/16-inch x 7/32-inch nozzle openings and delivering 25 g.p.m. at 45 pound pressure, served in effect as two laterals. The valve on the risers of the first 10 sprinklers would be turned off and spraying done by the second group of 10 sprinklers for a period of time which normally was one day. The following day the first group of sprinklers would be used after which the lateral would be moved to a new setting at a distance of 60 feet. Fifteen acres of a silt-loam soil sown to mixed grasses (intermediate, wheat, smooth brome, orchard, and alta fescue) were available but only about 7 acres were required for waste irrigation.

Importance of Cover Crop

An excellent illustration of the important part that a cover crop plays in the rate of absorption was observed at this plant. The grass mixture was sown (drilled in rows) about the first of May. Starting on July 25 the grass crop was cut. Wastes applied at this time to the uncut portion were absorbed at a rate which permitted sprinkling on the same area for the entire day's pack. The cut portion of the field exposed considerable bare ground between the planting rows and wastes were not absorbed as readily. Only about one-half as much waste could be absorbed. On one portion which was cut following a rain, packing of the soil by cutting and hauling operations further reduced the rate of absorption to only about one-quarter of that obtained on uncut grass.

Cost of Method

Comments on the cost of spray irrigation have been purposely omitted in connection with the discussion of individual installations. The translation of available cost data to a common basis is difficult because of a number of reasons among which might be mentioned: (1) variations in land values; (2) differences in (a) rates of soil absorption or (b) rate of application or (c) the usage to which the irrigated land is put (crop production, cattle grazing, or purely as a waste disposal area) which influence the acreage required for the disposal of the same volume of waste; (3) differences as great as 100 per cent in the waste output per case of the same produce packed; (4) great variations in the distance of the plant from the absorption area; (5) the necessity in some cases of purchasing rights-of-ways; (6) the extra cost involved in the crossing of roads, railroads or streams; (7) the necessity in some cases of laying the entire main pipe line underground, and (8) great differences in utilization of existing equipment such as pipe line to lagoons or other points of disposal, screening units, surge sumps, etc.

Even with the above uncertainties it is of interest to present the costs involved in converting existing methods of disposal to spray irrigation. In the following eight cases, 6 represent wastes from the canning of peas and 2 from corn canning. A spray irrigation installation capable of handling the volume of waste produced during the canning of peas will in many cases be adequate to dispose of wastes incidental to the canning of other products. Case packs are reported as No. 2 equivalents.

Plant A—$22,000 for irrigation equipment to handle the wastes from the packing of 190,000 cases. Plant B—$15,000 for irrigation equipment for a volume of waste averaging 900,000 gallons. Plant C—$12,500 for irrigation equipment to handle at a maximum the waste from 10,000 cases per day. Plant D—$9,500 for an irrigation system to dispose of the wastes from the canning of 140,000 cases of corn. Wastes were pumped through a 4-inch aluminum pipe for a distance of one mile. Plant E—$5,500 for a system to spray an average volume of 450,000 gallons per day. Plant F—$3,200 equipment costs for the wastes from total pea pack of 82,000 cases. Plant G—$3,200 spray equipment costs to handle wastes from a total pea pack of 76,000 cases. Plant H—$2,000 for a plant packing an average of 3,500 cases with a maximum of 5,500 cases.

The above cost figures apply to 8 seasonal canners located in the Midwest. If complete data had been available to include land, screening facilities and existing equipment at prevailing prices it is estimated that total over-all costs would not exceed twice those given. At two large eastern installations total costs, due in part to special circumstances, greatly exceeded costs of installations in other areas. However, in every case the over-all cost of spray irrigation compares favorably with, or is less than, other generally available standard methods of disposal. The difference in costs between a spray irrigation installation and a complete bio-filtration system so greatly favors spray irrigation that no reasonable comparison exists. As favorable as spray irrigation is cost-wise it must not be assumed that in every case spray irrigation will be the most economical or the preferred method of disposal.

Problems in Use of Method

As a method of waste disposal spray irrigation is in its infancy. Study and inspection of a number of spray irrigation installations has disclosed a number of problems and pointed to certain limitations.

Of prime importance is the availability of land within economic pumping distance. It may be more economical to employ spray irrigation at a distant site, say 2 miles, than to treat by another method at or close to the plant or to be subject to the treatment service charges expected by some municipal treatment works. For disposal at a distant site it may be more economical to employ two pumpings; the first one with a low pressure pump to a surge pit located at the site to be sprayed, followed by a high pressure pumping for spray irrigation in a relatively short pipe system.

Soil absorption characteristics play an important part in spray irrigation. At the present time it does not appear that a reliable method exists to predetermine the rate of water absorption or the capacity of the subsurface soil to assimilate water. Until such a method is available and readily adaptable the fundamental question of how much land is required to dispose of a given quantity of waste remains unanswered. Consultation with local well drillers, state geologists, state universities, and information from soil borings can be useful in selecting the most suitable area with respect to rate of absorption, capacity and knowledge concerning the likelihood of polluting underground water strata.

Avoiding Well Pollution

The possibility of polluting wells or of waste entering an underground strata which shortcircuits to a stream must always be a calculated risk. While of infrequent occurrence it has been known to occur from a "ridge-and-furrow" irrigation field, a lagoon, and a spray irrigation installation.

It is felt that probably the most important problem requiring extensive investigation is the relation of the type of ground or vegetative cover growth to waste absorption. The absorptive capacity of ground for pure water depends upon several factors. Applying cannery wastes carrying a suspended solid content up to about 6,000 ppm presents an added problem. Whenever a vegetative growth is absent or thin, objectionable mats may form. Even with a waste such as beet waste carrying a high concentration of suspended solids no solids

could be detected on the ground beneath a good vegetative growth.

During the 1951 survey it was repeatedly observed that, on the same field, poor absorption occurred where bare ground was exposed or the vegetal cover was sparse. This is in line with reports of the Soil Conservation Service on the beneficial effect of ground covers on absorption of rainfall. Undoubtedly the greatest rate of absorption was that which obtained on the wooded sandy area at Seabrook Farms but such areas are found only rarely in canning regions. That woods with its accumulated litter of humus provides an excellent vegetal cover is confirmed by the absorption obtained at the Francis H. Leggett Co. in nearby Landisville, N. J., where a wooded area on sandy soil is spray irrigated.

Choice of Cover Crop

Most canners will have to look to farm fields for their irrigation area. In such areas the best absorptions observed were on well established pastures or on fields with dense grass or weed growths. At the present time preference would be given to a short grass pasture cover crop. Alfalfa has been mentioned by some as a suitable cover crop. Until it attains a certain height and before it begins to mat down under repeated spraying alfalfa (and tall grasses) makes a good vegetal cover. On the stands observed, which admittedly were not as thick as they might have been, absorption was not as good after the crop had been harvested for hay. It has been suggested that the deep rooted alfalfa may not tolerate as heavy applications of water as shallow rooted grasses.

The type of cover crop may be dictated by the use to which the irrigated land is put. A tendency has been noted on the part of some canners to view waste spray irrigation as a means of increasing crop yields. Without doubt, the judicious application of certain cannery wastes to certain growing crops will increase yields, if there is less than optimum soil moisture. Such application becomes an agricultural problem with the rate and frequency of watering dependent upon the needs of the crop. Unless extensive crop acreage is available, it is inevitable that at times an excess of waste over that required for utilization will need disposal in some manner. It is believed that spray irrigation should be looked upon primarily as a means of waste disposal. Any utilization of waste for agricultural purposes should be a secondary consideration. It would appear, however, that spraying on pastureland offers not only a promising method of disposal for large quantities of waste, but also a financial return through the grazing of cattle.

Any cover crop requires mineral nutrients. To what extent mineral nutrients will be leached out by the application of abnormally high quantities of water is not known. The waste itself will supply some nutrients. Pea waste, for example, has been found to contain on an average 46 ppm. of total organic nitrogen and 9 ppm. ammonia nitrogen. Pea waste has a total phosphorus content of about 8 ppm. of which 5 ppm. are in the form of soluble phosphate. Corn waste has an average of 54 ppm. total organic nitrogen and 2 ppm. ammonia nitrogen. Total phosphorus averages 11 ppm. of which 5 ppm. are soluble phosphates. Should nitrogen or other soluble fertilizers be found to be required, its addition to the spray lines is easily accomplished with available auxiliary attachments. Studies involving soil analyses and crop and pasture yields over a period of several years are needed to answer questions raised by cannery waste irrigation. This is particularly true for a waste with an abnormally high pH from lye peeling operations. The very high pH of some wastes from lye peeling raises serious questions whether any vegetative growth can be maintained. Also, how long will aluminum piping withstand a pH of 10 to 11?

Importance of Screening

The greatest single source of operational difficulty was due to incomplete screening. On a few occasions pea vines, pieces of corn cob or miscellaneous trash gave trouble in the pumps. Relatively little difficulty was experienced in plugging of sprinkler nozzles. The major trouble was due to the collection of solids around the screen protecting the suction intake thereby adversely affecting both pump capacity and pump pressure. Correction of screening difficulties is relatively simply and inexpensive. Screening which hitherto has been acceptable for other forms of disposal is quite likely to be inadequate for spray irrigation.

Some State Boards of Health require that wastes be screened through 20, 30, or 40 mesh screens before admittance to a stream. Such requirements need not apply to spray irrigation. A perfect screening job through a 10 mesh screen would be preferable to occasional spill-overs from finer screens. (Water cooled gas engines used to power irrigation pumps utilize the waste for cooling. The cooling line is equipped with a strainer. The manufacturer should be consulted to determine whether wastes passing a 10 mesh screen will plug the strainer.) Screened solids or wind-blown leaves or trash must not enter the flow screened wastes ahead of the pump.

Size of Sump

The question of how large the surge sump should be remains to be determined. For complete freedom from odors wastes should be applied to the absorption area in a fresh condition. In actual installations the surge sump or reservoir feeding the spray pumps vary from 1000 gallons to the 2 mile canal at Seabrook Farms. A large surge sump has the advantage of providing storage capacity in the event of a temporary inability to irrigate and to provide a volume of waste for a more nearly continuous spraying operation if such is desired, e.g., use of gasoline powered pumps or large electric motors. A large sump has the disadvantage that the longer retention time permits the development of some septicity which may become objectionable when the wastes are sprayed. Also, a large sump acts as a settling basin for putrescible solids the disposal of which may present a problem. For most canners having a moderate volume of waste a concrete surge sump of 2 to 4 hours holding capacity would appear ample. If provision for emergency overflow can be provided and if a small float operated electric pump can be used, a sump holding only 15 minutes peak flow is satisfactory.

Many of the canners employing spray irrigation previously used lagoons. These lagoons or portions of them have been retained for emergency disposal of wastes. It would be prudent in every case to include emergency storage capacity as part of the irrigation installation.

Two sizes of sprinklers are in general use although a wide selection of sizes is available. A large sprinkler which irrigates an area of an acre or more appears particularly well adapted to spraying in wooded areas. Most of the sprinklers used for field spraying have nozzle openings of $\frac{5}{16}$-inch x $\frac{7}{32}$-inch. These sprinklers spray over a diameter of 120 to 140 feet. Information on the optimum sprinkler size for the different usages or conditions under which waste spraying may be conducted is needed.

The self-draining feature of quick coupling pipe for laterals which need to be moved is essential. On main distribution lines, however, some canners have experienced leakage with subsequent crop damage or odor production. Leakage occurs at periods when pumps stop operating and the line pressure drops. Light weight piping is available with special watertight fittings.

On windy days spray may be blown onto roads or adjacent property. The system should be set up to avoid trouble from this source.

The disposal of pea stack seepage along with factory wastes should be approached cautiously and in an experimental manner, if at all. One case of crop burning is known to have occurred. Remember that the flow of stack seepage continues at times when

dilution with factory waste is not available.

Spray Irrigation in Winter

Normally one does not associate spray irrigation with winter canning in those regions where freezing temperatures may be encountered; however, possibilities along this line suggest themselves. For example, in a region where freezing weather alternates frequently with mild temperatures it should be possible to impound wastes in a storage lagoon during those days when the ground is frozen or spraying is impossible because the temperature is below freezing. When conditions favor spraying wastes can be irrigated at a rate great enough to dispose of both the currently produced factory wastes and the impounded wastes. It is believed that cool weather will permit temporary waste storage without objectionable odors being released when the waste is subsequently sprayed.

The installation of an irrigation system should not be undertaken without consultation with specialists. As previously mentioned, the advice of state geologists, state university agricultural engineers and local well drillers should be sought to evaluate absorption sites with respect to absorption potentialities and evaluation of local well pollution probabilities. If the canning personnel includes competent engineers they should be able with technical advice from manufacturers of irrigation pipe and sprinklers to design and install a spray irrigation system.

There are many things to consider. For example, a factor in maximum rate of absorption is uniformity of spray distribution. This is dependent upon maintaining the correct pressure at the sprinkler nozzle throughout the entire length of the sprinkler lateral for the particular make of sprinkler used. The solution of this problem depends upon the length of the lateral, the size or sizes of pipe in the lateral, the size of the sprinkler (g.p.m.), the number of sprinklers, friction losses, and land contours. There is an economic problem involved in the size of the laterals. Spray laterals of great length of large size pipe may require several men and a truck for moving. Cases are known where wet field conditions resulted in bogging down of the truck so that tractors had to be used, with the result that moving was delayed, expenses increased, and damage was done to crops. The use of several relatively short 4-inch aluminum laterals appears to be more practical.

These and other considerations suggest that many canners would do well to consider the use of a reliable firm specializing in the installation of spray irrigation systems. The canner should also consult freely with the engineers from the State Board of Health. Their advice and counsel on many points will be valuable.

In appraising the present status of spray irrigation as a method of disposal it is apparent that while there are problems requiring further study, some of which involve extensive field experience to meet the varying conditions of an industry of widespread geographical distribution with a great diversity of wastes, the collective experience from some 22 installations indicate that spray irrigation will become an important method of waste disposal.

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Utilization of Waste from Canning of Deciduous Fruit

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By way of explanation of what will be covered in this paper, I wish to point out that several publications have already dealt with various aspects of the project I shall discuss, during the three years of its existence, and others covering it in more technical detail are in the course of preparation at Western Regional Research Laboratory. These will be published at an early date. Therefore, I shall attempt a rather general description of it, and in so doing I will necessarily use some excerpts from data which have already been published.

The basic problem of disposing of fruit waste is well known to many of you, and the present case is unique only in its magnitude, which arises from high concentration of fruit-canning operations in an area in and around San Jose, Calif.

A survey made in 1948 showed that in this area during the normal fruit-canning season of about 100 days' duration, approximately 70,000 tons of solid fruit waste was collected from the canneries operating in the area. This figure applies only to the material remaining on the 20 mesh screens required by state regulation for the removal of solids from liquid effluent discharged from the plants included in the survey. The juices and more finely divided solids passing through these screens were not utilized in the present studies.

Various means for disposal of this solid material which might be applicable to individual plants located in rural areas were manifestly inadequate to cope with such a situation. Disposal on open land, far enough removed from populated areas to avoid creation of nuisance, entailed high hauling costs and pest control expense at dumping areas.

In an effort to remedy the situation, a group of canneries in the San Jose area extended loans to a private enterprise intended to utilize the material. A plant was erected at a suitable location, but because of technical difficulties it proved unsuccessful, and the inoperative plant reverted to the group of canners.

A Technical Committee was formed, consisting of food technologists from the various interested canneries, and to this committee was assigned the problem of working out a more satistory method of disposal.

Since the problem was obviously important in varying degrees to all California fruit canneries, the Technical Committee was able to enlist the support of both the Canners League of California and the Cling Peach Advisory Board.

It was at once obvious that the principal problem involved was that of dealing with pear waste, since this was by far the predominant material in quantity, and also the one physically and chemically most difficult to deal with.

The Western Regional Research Laboratory had already been actively engaged in studies of pear waste, in the course of which a valuable fund of information on the chemistry of the material had been acquired. The Technical Committee, therefore, took its problem to Dr. Copley, Director of Western Regional Research Laboratory, and after a discussion of the project with him and his staff, plans were laid for a collaborative study of the problem.

Notwithstanding the fact that it had been unable to treat pear waste successfully, the existing disposal plant possessed many of the basic facilities necessary to such an operation, and thus provided the nucleus of an excellent pilot plant for the projection of laboratory studies to full scale operation.

Collaborative investigations conducted during the fruit seasons of 1949, 1950 and 1951 followed much the same organizational pattern. The canners who owned the plant made available its existing facilities and the Canners League of California provided a plant superintendent and maintenance crew to make the alterations deemed necessary for the experimental program, using its own funds supplemented by a grant from

the Cling Peach Advisory Board. Process engineers and chemists to carry on the experimental work were provided by the Western Regional Research Laboratory. The Technical Committee remained actively interested in the project and provided consultation and assistance as needed.

Results achieved in 1949 and 1950 gave sufficient promise of ultimate success that in 1951 emphasis was placed upon problems incident to actual commercial application of the process which had been developed. In keeping with this status of the project, the plant superintendent was given the responsibility of operating the plant to capacity most of the season, with only occasional digressions from the preferred process for experimentation.

In the early stages of the project it became fairly clear that the useful products of the process would be fruit molasses made from juice recovered from the waste, and the dried insoluble portion, or pomace, both of which would be principally useful as feed ingredients. The relatively high fibre content of the pomace appeared to confine its usefulness to ruminants.

In order to properly evaluate these products, the Technical Committee requested and received cooperation of the California State Agricultural Experiment Station, through its Director, Dr. Paul F. Sharp. Feeding tests with beef cattle and sheep were arranged through the courtesy of Dr. H. R. Guilbert and Mr. William C. Weir of the Department of Animal Husbandry at the University of California College of Agriculture at Davis. All of the data pertaining to the feeding value of fruit pomace and molasses included in this paper is taken from the work of Messrs. Guilbert and Weir as published in *California Agriculture*, Vol. 5, No. 11, Nov., 1951.

So many empty platitudes are spoken and written on the subject of "cooperation" that most of us have become allergic to the word itself, even without any moralizing on the subject. Perhaps I should apologize for having gone into so much detail about the genesis of this project before getting down to the details of it. However, I think it would be unrealistic not to note that this effective collaboration between technical men representing federal government, state government and university laboratories, as well as a sizable group of actively competitive canning firms, has produced results which could hardly have been achieved without such integrated effort—call it by whatever name you will.

Figure I illustrates typical fruit waste as delivered to the disposal plant.

FIGURE I

Fruit Waste as Received, Before Grinding

FIGURE II

Receiving Fruit Waste Ground at the Cannery

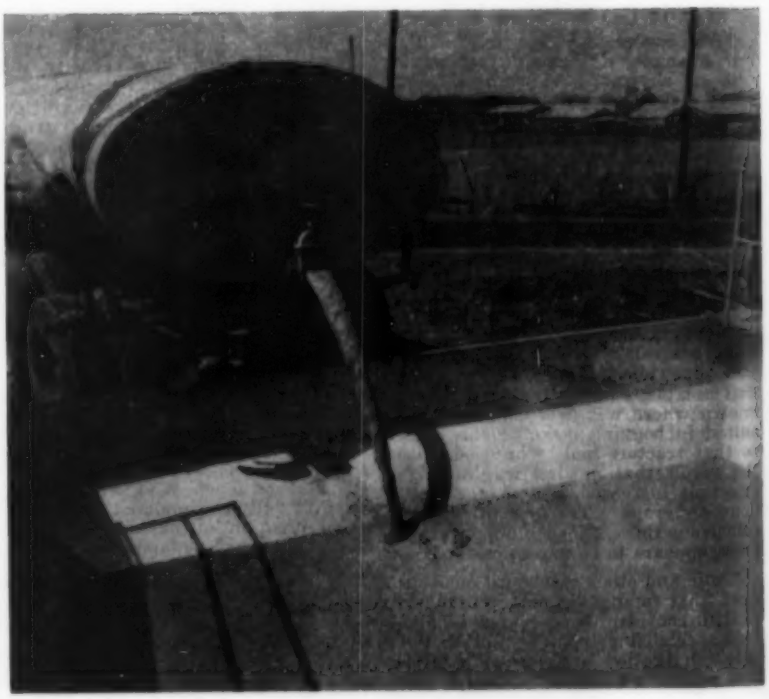


FIGURE III

Over-all View of Continuous Treater, Showing Lime-Slurry Tank, High Speed Mixer, and Holding Stage

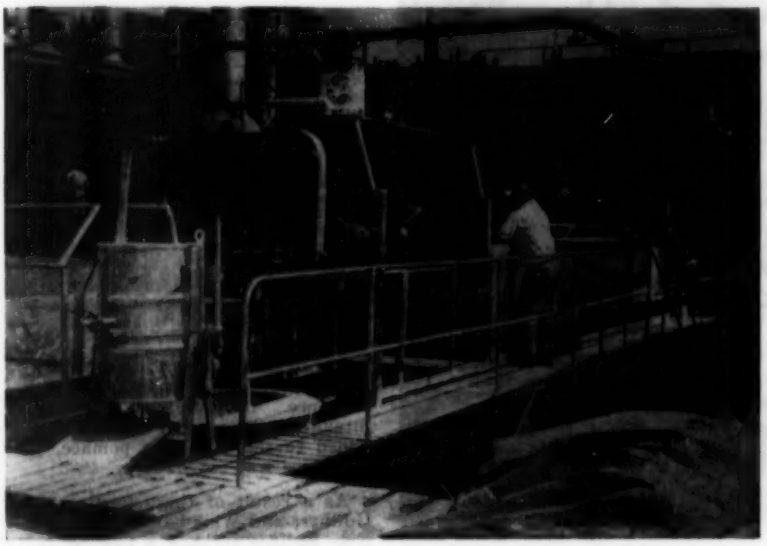
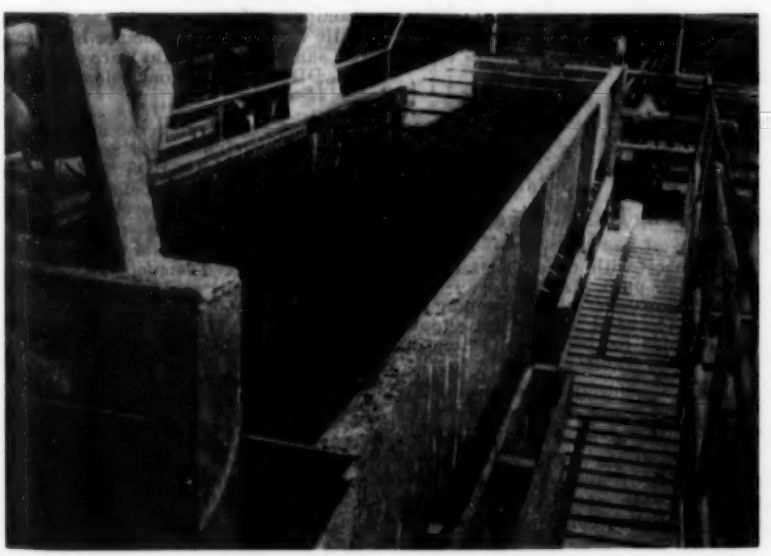


FIGURE IV

Interior View of Holding Stage of Treater



Before being treated chemically, the fruit waste is ground. Frequently this is done at the cannery to facilitate handling and storage of the material pending disposal. In this event, it is collected in tank trucks, as shown in Figure II.

Table I shows the results of a considerable number of analyses of pear waste reported by the Western Regional Research Laboratory. Waste processed in our investigations ranged from essentially this composition to mixtures rendered somewhat higher in fiber and lower in sugar by the admixture of other fruit wastes, and adherent water not removed in screening.

Treatment of the fruit waste to permit dejuicing is carried out in a specially designed continuous treating apparatus. This apparatus was developed by process engineers of the Western Regional Research Laboratory staff to continuously treat fruit waste in accordance with the process found most effective as a prelude to separating into clear juice and dejuiced pulp. Beginning in the left foreground and moving to the right, Figure III shows the lime-slurry tank, a high-speed mixer for incorporating the added lime in the ground fruit waste, and the large holding conveyor. Continuous control of pH is maintained through built-in electrodes, modulation being effected by manual adjustment of the lime-slurry pump.

In addition to control of pH and temperature, pitch of blades and speed of rotation must also be controlled to obtain optimum consistency for separation.

The treated waste is separated into sugar-bearing liquid and de-watered pulp by a specially designed de-juicing device.

Like the continuous treater, this apparatus also was developed for the project by process engineers of the Western Regional Research Laboratory staff. The unit illustrated in Figure V was built in 1950 and revised in 1951 to include some design improvements resulting from observation of the original machine in operation by the plant superintendent, the Technical Committee, and its original designers.

The "Y"-shaped manifold at the top of the dome distributes the treated waste equally to the two cloth-covered drums under a moderate hydrostatic pressure. Filtered juice runs into the drums from the peripheral area enclosed by the dome and runs out through the holes at the ends of the drums.

The de-juicer is provided with a string discharge for stripping dejuiced pulp from drum surface just below the point of contact between the drums. The de-juiced pulp or pomace

FIGURE V

Front View of Double-Drum De-juicer Showing Feed Manifold

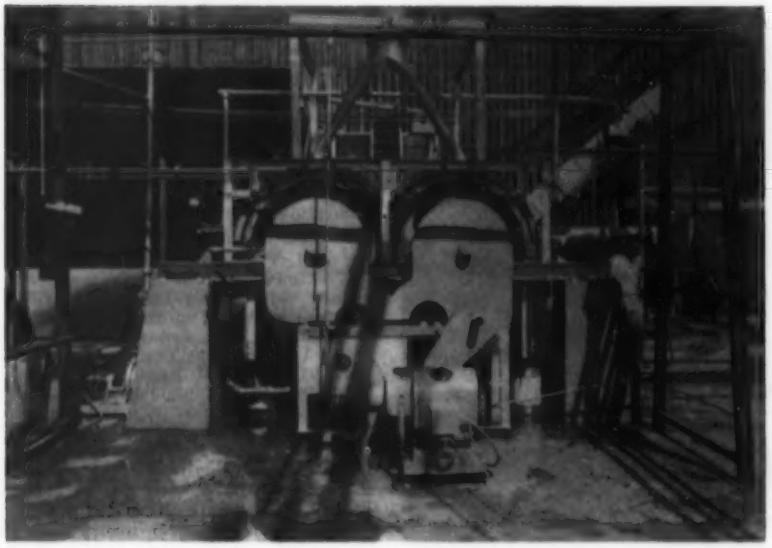


TABLE I

Analyses of Pear Waste Samples Collected during the 1946 Canning Season

Sample No.	Date Collected	Total Solids %	Protein N x 6.25 %	Ash %	Crude Fiber %	Total Sugars %
1	10-3	14.0	0.5	0.3	2.0	6.7
2	10-7	14.5	0.6	0.3	2.1	7.1
3	10-9	14.4	0.6	0.3	2.0	7.1
4	10-10	14.8	0.6	0.3	2.1	7.3
5	10-11	14.4	0.6	0.3	2.2	6.9
6	10-14	13.6	0.6	0.3	1.7	6.9
7	10-15	14.0	0.5	0.3	1.8	6.8
8	10-16	14.6	0.6	0.3	1.9	6.9
9	10-17	14.5	0.6	0.3	2.1	7.1
10	10-18	14.6	0.6	0.3	2.0	7.3
11	10-21	14.9	0.6	0.3	2.0	7.2
12	10-22	14.6	0.6	0.3	2.0	7.1
13	10-23	18.5	0.9	0.2	4.2	7.1
14	10-24	14.4	0.6	0.3	2.0	7.2
15	10-25	15.1	0.6	0.3	2.2	7.4
16	10-28	15.2	0.7	0.3	2.1	7.3
17	10-29	14.6	0.6	0.3	2.1	7.1
18	10-30	15.0	0.6	0.3	2.2	7.2
Av.		14.8	0.6	0.3	2.2	7.1
Av. on Moisture-Free Basis		100.0	4.1	2.0	14.9	48.0

From article by Potter, Benvenue and McComb, *Western Canner and Packer*, April, 1948, page 56.

is then conveyed to a conventional rotary flame drier. The juice or "sweet liquor" is concentrated to about 70° Brix molasses in a multiple effect evaporator.

Typical analyses of the resulting products is shown in Table II, along with generally accepted values for cane molasses and beet pulp to permit comparison. These latter substances were chosen as positive controls in animal feeding tests. Cattle feeding tests at the University of California at Davis were set up to provide a four-way comparison of the fruit molasses and pomace with cane molasses and dried beet pulp. A four-way comparison was undertaken, grouping the animals according to the test supplements added to their basal ration, as indicated in Table III.

Table IV shows the results of steer feeding tests composited with respect to each of the four supplements used.

Feeding tests with sheep also showed that pear pomace and pear molasses were satisfactory feed ingredients for sheep. The palatability of the pear molasses for sheep was found to be so great that self-feeding led to over-eating and digestive disturbance. However, on a controlled intake of 20 percent pear molasses added to the dry pear pomace, performance was satisfactory.

TABLE II

Composition of Feed Used in the Cattle Feeding Trials

	Pear pulp %	Molasses* Pear molasses %	Molasses* dried beet pulp %	Cane* molasses
Dry matter	92.4	76.4	91.9	74.0
Ash	5.4	5.3	5.1	9.0
Protein (N X 6.25)	5.4	1.2	10.7	2.9
Ether extract	2.9	0.0	0.7	0.0
Crude fiber	21.5	0.0	16.0	0.0
Nitrogen free extract	47.2	69.9	59.4	62.1
Lignin	25.0	0.0	6.0	0.0
Cellulose	23.9	0.0	.....	0.0
Calcium	2.2	.....	0.62	0.74
Phosphorus	0.11	.....	0.09	0.08

* Average composition according to Morrison F. B., Feeds and Feeding.

As a result of these feeding tests, Guilbert and Weir have estimated the pear pomace to have a feeding value equal to 78 percent of molasses-dried beet pulp, and pear molasses to have about 120 percent of the feeding value of cane molasses. (*California Agriculture*, Vol. 5, No. 11, Nov., 1951).

Chemical analyses of pear molasses showed it to be free of DDT, even when made from waste derived from fruit heavily contaminated with DDT. Some residual DDT was found in the pear pomace.

In order to determine the possible significance of these residues from the standpoint of carryover to the meat of cattle to which pear pomace had been fed, samples of body fat were analyzed for DDT at the conclusion of the feeding tests.

Table V shows that the animals on pear pulp and molasses accumulated only slightly more DDT than those receiving beet pulp and cane molasses, and that all of the levels were low enough to constitute no probable hazard to the consumer of the beef.

The use of feed components containing DDT in any measurable quantity is not permitted in rations for milk cows because of the tendency for stored DDT to be excreted in the milk.

Small-animal feeding tests made at Western Regional Research Laboratory appear to rule out any hazard from the feeding of pear pomace or molasses due to residues of lead arsenate and fluorine (Kryolite) sprays used on the fruit as recommended by the California State Department of Agriculture.

TABLE III

Summary of Data for Each Lot of Fruit Molasses and Pomace with Feed Components

All figures are in pounds unless otherwise indicated

	Lot 1 Beet pulp and cane molasses	Lot 2 Pear pulp and pear molasses	Lot 3 Beet pulp and pear molasses	Lot 4 Pear pulp and cane molasses
Number in lot	6	6	5	4*
Average days per steer	94.5	99.2	92.2	90.8
Average initial wt.	822	811	829	811
Average final wt.	1056	1051	1062	1045
Average daily gain	2.48	2.42	2.53	2.58
Total daily ration	26.2	25.8	25.3	28.0
Total feed for 100 lbs. gain	1057	1066	1000	1085
Carcass grades				
Good	4	2	4	2
Commercial	2	4	1	2
Average dressing	60.7%	59.4%	59.9%	59.1%

* One steer in Lot 4 was removed from the test. See text for explanation.

TABLE IV

Data on Combined Lots for Comparison of Each Feed Investigated

All figures are in pounds unless otherwise indicated

	Lots 1 & 3 Beet pulp	Lots 2 & 4 Pear pulp	Lots 1 & 4 Cane molasses	Lots 2 & 3 Pear molasses
Number in lot	11	10	10	11
Average days per steer	93.5	95.7	92.9	96.0
Average initial wt.	825	811	818	819
Average final wt.	1059	1048	1052	1056
Average daily gain	2.50	2.48	2.52	2.48
Average daily ration				
Alfalfa hay	8.9	9.5	9.8	8.7
Oat hay	1.8	1.9	1.9	1.8
Barley	7.1	7.1	7.1	7.1
Beet pulp	3.5	..	3.5	3.5
Pear pulp	..	3.6		
Cane molasses	3.5	3.5	3.6	..
Pear molasses			..	3.5
Cottonseed meal	1.0	1.0	1.0	1.0
Total daily ration	25.8	26.6	26.9	25.6
Feed for 100 lbs. gain				
Alfalfa hay	356	383	389	351
Oat hay	72	77	77	73
Barley	282	287	282	287
Beet pulp	141	..	141	144
Pear pulp	..	143		
Cane molasses	141	143	141	..
Pear molasses			..	142
Cottonseed meal	39	40	39	40
Total feed for 100 lbs. gain	1031	1073	1068	1036
Carcass grades				
Good	8	4	6	6
Commercial	3	6	4	5
Average dressing	60.3%	59.3%	59.9%	59.7%

TABLE V

Analysis of Beef Fat

Lot I Beet Pulp Cane Molasses		Lot II Pear Pulp Pear Molasses		Lot III Beet Pulp Pear Molasses		Lot IV Pear Pulp Cane Molasses	
Steer No.	DDT Contents*	Steer No.	DDT Contents*	Steer No.	DDT Contents*	Steer No.	DDT Contents*
855	1.9	818	4.7	858	2.8	828	4.2
872	1.9	867	3.0	857	3.5	853	4.3
835	2.2	851	3.6	849	2.2	829	1.9
833	2.5	869	3.0				
Total	8.5	Total	14.3	Total	8.5	Total	10.4
Average:	2.13	Average:	3.58	Average:	2.83	Average:	3.47
Rank:	1	Rank:	4	Rank:	2	Rank:	3

* ppm.

Survey of Water Use Practices in California

By Edwin S. Doyle,
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National Canners Association

Water might be termed the life blood of a cannery because it is one of the most essential and extensively used of raw materials. The problem of water in general has become the subject of much discussion, largely due to widely publicized water shortages in a number of heavily populated areas. These shortages have brought about a much wider appreciation of the importance of water in our complex society.

In a letter of transmittal in March, 1951 (1) Vinton W. Bacon, Executive Officer of the California State Water Pollution Board says, "Salt water from the ocean has polluted approximately 90,000 acres of fresh water-bearing deposits in thirteen major and minor ground-water basins of the California coast and inland bay areas, and threatens seven others. . . . Continued pumping of fresh ground water in these areas at present rates will allow further encroachment of salt water, resulting in widespread deterioration of fresh groundwater supplies."

Salt water intrusion is, generally, limited to coastal areas and will not affect the majority of the canners, but there are water shortage problems in many of the inland areas. R. W. Hawksley (2) states:

"Certain West Coast localities are suffering from an increasing scarcity of water. While new sources of water are under study, and being developed, it is probable that a definite policy of water conservation will always be necessary on the Pacific Coast, and particularly so with increasing population and industrial activity.

"According to some estimates industrial uses account for 25 percent of the national consumption of water. Irrigation and sanitary use of water admit of only slight possibilities for savings but many industrial plants have an excellent chance to save water. A few industries took an early initiative in appraising their own water use practices that were in need of revision, and have achieved substantial savings in their own water consumption, notably the petroleum products industry and the paper and pulp industry. In other industries, however, little has been done in this direction, and there is much room for improvement.

"Besides the obviously desirable public relations aspects of conserving the general water supply, there are important economic considerations as well. A well planned water conservation program in a particular plant will often produce very attractive dollar savings."

A published (3) example of this is the Jacob Ruppert brewery in New York, which with simple changes was able to save 25.5 percent of its total water or an annual 72,000,000 gallons worth $15,000, with a total outlay of $5,000.

This saving was accomplished with a cooling tower and a careful analysis of water use so that water from every operation was reused to the greatest possible extent before final discharge. The brewery also installed automatic and hand-valve shut-off nozzles on hoses and constantly reminded their workers to save water. This is a dramatic and important saving and is indicative of what might be accomplished in the canning industry. However, it should be realized that there are problems peculiar to each industry which have to be studied to determine the extent to which water can be reused.

Study of Canning Industry

In view of known water shortages, as well as the closely allied and pressing problem of the disposal of large volumes of liquid wastes, it was considered advisable to survey the canning industry to determine (1) the seriousness of this problem as it affects the canning industry, (2) comparative volumes of water being used in different plants for packing various products, (3) what water recirculation and reuse are being practiced and what others may appear possible, and (4) what additional studies are necessary to determine the feasibility of various water conservation methods.

Surveys were made in spinach, asparagus, cling and freestone peach, and fruit cocktail and fruit salad canneries in northern and central California in 1951 during the canning seasons, and the following information on total water use was obtained:

	No. of Canneries Visited	Average Water Use per 2½ Equivalent Case
Spinach	18	190 gals.
Asparagus	13	255 gals.
Cling and Freestone Peaches	21	65 gals.
Fruit Cocktail and Salad	8	57 gals.

These water volumes are estimates made by plant personnel usually based on pump capacities and may be in considerable error for any individual plant. The averages, however, are probably within a range of sufficient accuracy for purposes of general discussion. A significant factor is the spread between plants packing the same product. The spread between the maximum and minimum volume of water used per case in spinach canneries surveyed was almost 5 to 1; asparagus, over 6 to 1; cling and freestone peaches, 6 to 1; and fruit cocktail and salad, 4 to 1. Even allowing for considerable error in the upper and lower figures, it appears that some canneries may be using more water than is necessary. It was apparent from this survey that the tendency of many plants is to use all the water available without regard to the effect on the future availability of water. The greatest conservation efforts were noted in plants that were faced with a critical water shortage or where the obtaining and disposal of water had become an appreciable cost item. That water is becoming critical in many areas is demonstrated by the fact that during the last two or three years many of the canneries visited had been forced to drill new wells, lower old wells or draw heavily on municipal water supplies. If the water tables in some areas continue to decline many canneries may be critically affected.

Reuse of Water

There are many water recirculation and reuse practices now in effect in the various plants visited, but none is universally used.

The percentage of total water use represented in can cooling was variously estimated at from 25 percent to 50 percent in spinach packing and 50 percent to 65 percent in peach and cocktail packing. This represents the greatest single use of water, and this water is relatively uncontaminated and suitable for reuse except that the temperature averages from 80°F. to 125°F. If supplementary air cooling of cans is practiced the temperature may be 160°F. or higher. The greatest saving in water is accomplished with the installation of cooling towers to lower the temperature, and continuous recirculation with only enough fresh water added to make up the evaporation and carry over loss. It is fairly simple to collect cooling water from continuous coolers, but retort cooling necessitates a collection sump and a holding tank. The advisability of chlorinating recirculated cooling water is well accepted, but it is not likely that in-plant chlorination will maintain an adequate residual. Auxiliary chlorination of the cooling water after passing over the cooling tower is the usual procedure, although a few plants recirculated without chlorination but with the addition of a high percentage of fresh water.

In some plants cooling water was reused for product fluming and washing without recirculation over a cooling tower. The effect of the temperature of this water on the product and the efficiency of the wash should be

investigated, as well as the multiplication of microorganisms and the growth of slimes. In-plant chlorination may have a favorable effect, but it should be determined whether or not additional chlorination is necessary.

In a few instances cooling water was collected and held for plant cleanup. The elevated temperature, however, is favorable for the growth of microorganisms, and chlorination was usually necessary.

In peach and particularly fruit cocktail operations, a good deal of incidental water is used for lubrication of belts, graders, cup up and cup down shakers, slicers, dicers, cluster breakers, etc., and cooling water may be a satisfactory source. It could undoubtedly be used for flushing gutters and transportation of wastes not manually picked up and carried from the plant.

Wash Water Reuse

Another conservation practice was the reuse or recirculation of product wash water. Spinach is usually put through several washers, which have been estimated to use in the neighborhood of 200 gallons per minute each. Reuse should be from the last washer to prior washers in turn. A number of canners are of the opinion that spinach wash water cannot be safely reused. However, in several plants partial reuse, and in one almost complete reuse, was being practiced. It may be that more extensive washing procedures make such reuse possible, but this would nullify to a great extent any saving of water over a more limited washing procedure using fresh water but giving comparable results. In certain types of cling peach washers for lye removal it is the general practice to recirculate water from the last half of the sprays and use it for the first half of the washing sprays. In most plants there is enough water from product washers to keep the gutters flowing. However, if reuse and conservation make this impracticable, a portion of the screened waste flow can be used to flush the gutters as was the practice in one or two plants surveyed. This is contaminated water, and it is not known how much it would contribute to insanitation of the gutters or what, if any, chlorination would be necessary.

Some plants recirculate the hot water in spray blanchers, primarily to save on heating costs, and in a few cases it was used as a preheating wash before blanching.

Most of the plants visited did not feel they were wasting water during cleanup. However, from observations made prior to this survey we have observed considerable wastage from inefficient cleanup methods, wide open hoses left running, etc., as well as leaking valves. Automatic shut-off valves; efficient cleaning methods; and most important, the education of all employees, including the cleanup crew, toward a conscious saving of water should be considered. A steadily dripping faucet is said to waste more than 24 gallons of water a day —almost 9,000 gallons a year, while a leak ⅛-inch in diameter will waste 9,000 gallons in three days—over 1,000,000 gallons a year. The repairs necessary to stop this kind of wastage are not difficult.

Summary and Conclusions

The major water uses in canneries surveyed appear to be:

1. Can cooling.
2. Product washing.
3. Plant cleanup.

Some of the possibilities of water conservation appear to be:

1. Recirculation of can cooling water over a cooling tower.
2. Reusing can cooling water for fluming and for product washing.
3. Reusing can cooling water for incidental plant water such as dicer sprays, belt lubrication and boilers.
4. Reusing can cooling water for plant cleanup.
5. Recirculating water in some types of product washers.
6. Reusing water from product washers in prior washers.
7. Reusing wash water or screened waste water for flushing gutters and transportation of wastes. (May increase waste treatment problems.)

There are undoubtedly other water conservation possibilities that will be apparent to the canner who makes a careful analysis of the use of water in his operations.

Reuse of the cooling water warrants first consideration as it is usually relatively uncontaminated although the temperature has been raised. Reuse usually necessitates pumps and a collecting sump and holding tank, unless it is a constant overflow from continuous coolers. Recirculation over cooling towers should give the greatest savings. It may also be possible to reuse it without cooling for product washing, to save it for plant cleanup and similar uses. Changes in present operating practices should not be made, however, without careful consideration and study. The increased temperatures may adversely affect some products, and the microbiological flora may necessitate chlorination. Chlorination is probably necessary in many water recirculation and reuse systems. Recirculation in some types of product washer systems is also possible providing satisfactory results are obtained without increasing the use of fresh water in direct ratio to the amount recirculated.

The various water conservation possibilities raise many questions that are unanswered by this exploratory survey. For example:

1. What is the most efficient type of equipment in use both for product quality and water use?
2. How much water is necessary per unit of product?
3. Does recirculation of the water in spinach, asparagus and similar washer systems accomplish satisfactory cleaning of the product with any actual saving of water?
4. What levels of chlorine should be carried in recirculated cooling water to guard against all possible dangers? A few canners do not chlorinate at all.
5. How long can recirculation be continued in a cooling system without impairing the quality of the water to the extent that it might cause trouble?
6. Is the quality of cooling water (temperature, organic content, oil, microorganisms, etc.) satisfactory for other uses in the plant such as product washers, fluming, belt and shaker sprays, and boilers? What treatment, if any, would be advisable?
7. How much water is wasted from leaky valves, hoses left running, inefficient cleanup practices, etc.?
8. How much water would various conservation measures actually save?

References

(1) "Sea-Water Intrusion into Ground Water Basins Bordering The California Coast and Inland Bays", California Department of Public Works and Division of Natural Resources.

(2) Hawksley, R. W., "Use Less Water and Save Dollars", *Western Industry*, May, 1951.

(3) Travis, H., "They Cut Their Use of Water 25%", *Food Industries*, 22(10), p.52 (1950).

Tomato Products Conference

A proposal to modify the present standard of identity for tomato catsup to permit the use of corn syrup as an optional sweetening ingredient was discussed at the Tomato Products Meeting held in Atlantic City January 21.

The meeting was attended by representatives from the catsup-producing areas. The advantages of using a liquid sweetening ingredient were brought out.

The National Canners Association was requested to act for the industry to bring about a public hearing on this proposed change in the standard of identity for catsup.

FISHERY PRODUCTS CONFERENCE

Fisheries Developments in Peru

By Norman D. Jarvis,
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U. S. Fishery Mission to Peru

Before starting a review of developments in the fishing industry of Peru, I should like to answer in some detail the question, what is the Fish and Wildlife Service doing there? Technical assistance to foreign countries has been a part of the foreign policy of the United States since 1938, when the President created the Interdepartmental Committee on Scientific and Cultural Cooperation. This policy was greatly strengthened and expanded by the famous Point Four of President Truman's inaugural address of January, 1949, which was formally authorized by Public Law 535 of the 81st Congress.

It is not my place to discuss the desirability of this policy which has been established and continued by the President and the Congress. I should like to point out that the Fish and Wildlife Service does not propose projects for assistance to foreign governments in the field of fisheries. These proposals must be initiated by the foreign government, approved by the Department of State, and submitted to the Fish and Wildlife Service for consideration. When these proposals come within the competence of the Service and appear to be practicable, it is the responsibility of the Fish and Wildlife Service to provide the assistance requested. The primary interest of the Service in foreign countries has been and will be in increasing production of fishery products for domestic consumption, so as to improve the diet of the people in proteins, vitamins, and essential minerals.

That is just what we have been doing in the two missions of 1949-50 and 1951. The Peruvians regularly eat dried salted fish when it is available. The product prepared heretofore is of low quality and does not keep long enough to reach the markets of the interior. Our first activity was a study of curing methods. A product of improved quality was prepared which had better keeping qualities. The improved salting method has been taught as widely as possible, and a handbook of salting prepared.

In fish curing work, we have also made a study of smoking. Methods have been developed for smoking several of the cheaper fish, especially material now wasted, such as bonito roe. These have been very popular among the Peruvians and have good keeping qualities. Sample lots were still in good condition at the end of two months, when finally used. Work on smoking also includes such things as types of fuel and methods best suited for local conditions.

The Fish and Wildlife Service has done a lot on fishery development and educational work in the United States—what our Latin friends call "propaganda"—to increase the use of fresh and canned fish. As much time as possible was given to this work in Peru. Our knowledge of fish cookery, the food value of fish, how to prepare fresh fish for the table, may be scanty, but in Peru *nothing* is known on these subjects. A cookbook has been prepared, with recipes most likely to appeal to the Peruvians, using low cost species and methods, and including other information to encourage the use of fish in Peru.

The Republic of Peru has no "pure food law", nor have there been any provisions for cannery inspection and control. I was requested by the Peruvian Government to devise a pure food law adapted to local conditions, and especially designed to permit regulation of Peruvian canneries and fish packing plants. Detailed regulations were also worked out for the inspection of fish canneries, including sanitation and general cannery inspection. A manual of instruction was prepared for cannery inspectors. The law and regulations have just been approved. The law follows closely the Food and Drug Act of the United States. Inspection procedure has been modeled on that of the State of California. The result of this work will be toward equalizing conditions of competition. Submarginal packers will be eliminated from the industry.

During the past 10 years a great development has taken place in the fishery industry of Peru. Fishery products, principally canned bonito, frozen swordfish and tuna, and fish meal, have become one of the most important exports and sources of dollar exchange. According to Peruvian reports, only the exports of minerals, cotton, and sugar are more important. The Ministry of Agriculture, in its most recent reports, estimates the total catch at 133,761,500 pounds, which is more than five times the catch of 1940. Bonito was the most important species in 1940, the catch amounting to approximately 5,900,000 pounds, or 22 percent of the total. In 1949, bonito was even more important, with an estimated catch of 83,855,000 pounds, or 62.7 percent of the total. Yellowfin tuna was in second place with a production of 10,716,695 pounds, or 8.0 percent of the total. Swordfish, which was of minor importance in 1940 and not included among the 10 species comprising three-fourths of the catch, was the third most important species, with a reported production of 5,811,000 pounds in 1949.

Exports of fishery products in 1949 were estimated by the Bureau of Fish and Wildlife of the Peruvian Government at 25,410,000 pounds. Domestic consumption is known to have increased since 1940. Efforts of the Ministry of Agriculture to promote consumption of fishery products within the country are showing some results, but the population of Peru could consume a still larger fish supply. A marked increase in the rate of domestic fish consumption will not be possible until local marketing, transportation, and preservation facilities are further improved. The Fishery Mission concluded that Peru could readily utilize 140,000,000 pounds of fish for domestic consumption, and that the waters off the coast of Peru could supply this amount.

The first canners found that tuna was obtainable only occasionally off much of the coast, within the range of the small craft comprising their fleet. Bonito could be taken in quantity within a few miles of port. Moreover, the fishermen were accustomed to taking bonito on short trips and could not see why they should make a longer trip for tuna when they could catch a load of bonito and be back in port within a few hours. That is their attitude today. Canners at Ilo and Mollendo in the south of Peru, where tuna are regularly present within the range of the fishery fleet, report difficulty in requiring the fishermen to bring in tuna rather than the more easily obtainable bonito.

Within the past year, the canning of tuna has stopped almost entirely. Yellowfin tuna and skipjack are canned regularly only at Ilo and Mollendo in the south, and at Paita and Pimentel in the north. A great part of the tuna catch is now frozen. At all other canneries, the pack consists entirely of bonito.

It is only in the extreme north and south that the tunas regularly come within the range of the fishing fleet, owing to the presence of warm-water tongues or wedges in the ocean. Fiedler (Fishery Leaflet 75) says "the significance of the warm-water tongues is that many of the important species in the Peruvian fisheries are warm-water forms. This applies especially to tuna and skipjack. . . . The invasion of the cool coastal water by the warm swirls brings such fish within easy range of boatmen from the fishery settlements." The cool coastal current flowing north along the coast of Peru is displaced to some extent in the summer season, from

December to April. When this occurs, there is a penetration of the warm counter-current, "El Niño," from the north. The rate of this penetration varies from year to year. In some years it is so extensive as to cause wide changes in climate and water conditions. In such years, yellowfin tuna and skipjack are taken close to shore in the central coastal area, while bonito, which seem to prefer cooler water, are very scarce. These abnormal years apparently occur in cycles. The year of 1941 was such a season. The Fishery Mission of that year took considerable amounts of tuna and skipjack close to shore in its exploratory fishing off the Callao area. The year of 1951 has also been an abnormal season. The catch of bonito has been below the off-season average, and had not picked up as of the middle of December, although that is normally the height of the canning season.

It should be remembered that the canning industry in Peru had its first development during World War II. Canned products were in very short supply in the United States. The bonito landed in Peru was found to make a good quality canned product. It was not subject to price ceilings. A number of food sales interests in the United States became interested in Peru as a possible source of supply and encouraged a rapid development of the fish canning industry. The cooperation of canning machinery and supply firms in California was obtained. These firms supplied the necessary equipment and technical instruction that made development possible. At the end of the war, the United States was the entire export market for sale of canned bonito and tuna. In 1945, exports of canned bonito and tuna from Peru amounted to 146,142 cases of 48/halves. Since the war, an effort has been made to build up other export markets. Shipments are now made to Belgium, Great Britain, Italy, and Switzerland.

Other South American countries are also buying some canned bonito and tuna from Peru, especially Argentina and Venezuela. Sales to all of these countries are made difficult, however, by exchange difficulties, and import restrictions. The United States is still the most important export market.

There has been no system of cannery inspection and control in Peru. As a result, some lots of canned fish from Peru have been found unsatisfactory. The Peruvian Government then decided that the fish canning industry required a system of sanitation and inspection controls like that of California. The Fishery Mission to Peru was requested to set up such a system to eliminate undesirable practices in the industry. This attitude probably was influenced by rejections of Peruvian canned packs and the visit of a representative of the U. S. Food and Drug Administration to Peru.

Some rejections were made because of spoilage, but the principal cause has been mislabeling bonito as tuna. The general position of the Peruvian industry is that they are not to blame for the situation, that the first shipments made were labeled as bonito, and that Food and Drug examiners at New York insisted that the fish was tuna. Therefore, they merely complied with the decision of the examiners. Later, after the trade was built up, the Food and Drug examiners changed their minds after the California industry complained. Others in the Peruvian industry claim that the bonito (*Sarda chilensis*) is a tuna and therefore may properly be labeled tuna. This claim is based principally on a publication from the University of California Press, 1936, *Marine Fish of Southern California*, by Percy S. Barnhart. European publications are also occasionally cited. A decree of the Peruvian Government is also advanced as evidence. This decree, however, was promulgated after the ruling of the U. S. Food and Drug Administration, when the question of the proper labeling of tuna style packs had become an extremely important issue to the Peruvian canning industry.

The truth of the matter, so far as can be determined, is that the industry in Peru has been fully informed as to Food and Drug regulations of the United States since the construction of the first modern fish cannery in Peru in 1941. The canneries have been built with the help of commercial technicians from the United States, and, in the early stages at least, were operated under their instruction and direction. Cans and canning equipment have been imported directly from the United States. Can and machinery makers of the United States have supplied all the information available to their customers in the United States. Sales and marketing agencies from the United States have been active in Peru since 1942. These agencies are certainly acquainted with labeling regulations in the United States. It is believed that, knowing the product could not be distinguished from tuna by the average consumer, it was mislabeled deliberately.

The first fishery mission was assigned to Peru in 1941, before the great development of the fishery industry in that country. It was made at the request of the Peruvian Government, which paid all expenses. The assignment was to determine the fishery resources of Peru, and to study methods for their development, especially for domestic consumption. The supply of meat was, and is, extremely short. If it were found possible to make up the deficiency by a greater local use of fishery products, not only would the Peruvians have a better food supply, but since much of the meat had to be imported, foreign exchange would be saved. Since the Government had no special organization for the development and control of fisheries, recommendations were also requested on this point. In addition to the general fishery survey, the mission did work in exploratory fishing and oceanography, made a collection of more than 2,000 specimens of fish, and did some experimental work in fish curing and canning.

The mission found that total landings of fishery products were 26,000,000 pounds in 1940. At that time, four canneries were in operation. While all of these plants packed some fishery products, two of the four were principally packers of fruits, vegetables, meat, and specialty products. Canning methods, cans, and canning equipment were primitive and obsolete. Fishery products were confined to tuna, packed European tuna style; bonito, salmon style; and machete (a type of herring) in pound ovals, canned California sardine style. No canned products were exported. Production was estimated at less than 20,000 cases.

In accordance with the recommendations of the fishery mission and following consultations between the Peruvian Government and the U. S. Fish and Wildlife Service, a fish and wildlife bureau was established in the Ministry of Agriculture, Republic of Peru. The primary function of this bureau is to increase the production of fish for domestic consumption so that a population badly needing protein foods may have a sufficient supply of good quality fishery products at a reasonable price. It is also intended to institute a scientific system of fishery management to conserve the fishery resources of both salt and fresh water. In October, 1949, at the request of the Government of Peru, through the Institute of Inter-American Affairs, R. O. Smith, of the U. S. Fish and Wildlife Service was detailed as Scientific Advisor to the Fish and Wildlife Bureau, Ministry of Agriculture, to help this organization institute a sound program along the lines outlined above. The Peruvian Government is paying approximately half of the cost of this project.

Peru later requested the services of a technologist of the U. S. Fish and Wildlife Service to equip and put into operation a technological laboratory for the Peruvian Fish and Wildlife Bureau. I was given this assignment, working in Peru from October, 1949, to April, 1950, and from June 1 to December 7, 1951. Emphasis was laid especially on improving methods of fish curing and on organizing a system of product inspection and sanitary control of firms packing fishery products. Work on canning was limited to regulatory functions. No re-

search problems or training in canning technology were undertaken. Training in commercial canning methods is done entirely by representatives of the canning industry and allied trades from the United States. A thorough survey was made of canning methods and conditions, so that regulations would eliminate any undesirable practices in the industry. Some of my findings, but not all, agree with those of Perry Clark of the Food and Drug Administration. It was possible to devote more time to this survey, and information was obtained which was not available to him.

In 1951, there were 43 canneries in Peru for the purpose of packing fishery products. In capacity, they range from a maximum of 2,500 cases a day down to 50 (on a basis of 48/½'s to the case). Four of these canneries are packing herring (*Ethmidium chilcae*) in pound ovals, California sardine style, but two of the four also pack bonito, tuna style. The sardine style pack is almost entirely for domestic consumption, although small amounts are occasionally sold to Ecuador, Bolivia, and the Amazon backwaters of Brazil near the Peruvian border. These same canneries also pack bonito, salmon style (raw pack), in No. 1 tall or 300 cans. This is packed for domestic consumption. Nineteen of the canneries are located in Lima and its adjoining port of Callao. The central coastal zone from Chancay to Pucusana, a distance of about 120 miles, and including Lima-Callao, has a total of 24 canneries. The northern coastal zone from Tumbes to Huacho has 15 canneries, while the southern coastal zone, including Pisco to Ilo, has 5 canneries. The 9 largest canneries pack more bonito than the remaining 35 plants. It is estimated that their portion of the total is 60 percent.

It is estimated that the pack of bonito and tuna in 1949 was 566,000 cases (48/½'s). Of this amount, 90 percent was exported. The 1950 pack was about 580,000 cases. Information on the 1951 pack is not yet available, but it is believed to be much less than the two preceding seasons. My estimate is about 350,000 cases. The amount of canned bonito going into domestic consumption is about 60,000 cases annually. This is mostly flakes, or parcels not accepted for export. The average retail price of canned bonito in ½ tuna cans is about S/2.50 or about 16.5 cents U. S. Samples were purchased at retail and examined. The flakes were of standard quality, with workmanship in packing no better than average, salting heavy, odor passable. The cans were invariably overfilled. I was told that the domestic trade insisted on a pack without headspace. The samples of solid pack examined varied from better than average to substandard, but not unfit for human consumption.

The development of the fish canning industry has undoubtedly increased the consumption of canned fish in Peru. In addition to tuna-style packs, there is an annual production of about 50,000 cases of sardines in pound ovals, bonito salmon style, together with a number of specialty products packed in small amounts. These include various shellfish such as clams, mussels, and sea snails in brine or oil, smoked bonito in oil, anchovies sardine style in oil, anchovy fillets Spanish style, and caviar from bonito and mullet roe. While the quality may not be equal to that of the imported canned fishery products, the price is much lower. In spite of inflation, local canned fishery products are now within the reach of the Peruvian middle class. Imported canned fish, varying in price from 75 cents U. S. for a five-ounce drained weight can of shrimp, to $2.00 for a 1-pound tall can of salmon, is a luxury to be afforded only by the rich.

During the 1950-51 season, some 40,000 cases of bonito in brine were packed for the export market. Most of this went to the United States but some to the European market, especially Italy. For the Italian market it is labeled "salmon" in very large letters, "type" in very small. The label has a conventional picture of a salmon. This pack is made in No. 300 or 1-pound tall cans with a drained weight of about 14 ounces. The fish is precooked as usual, the light meat fillets are cleaned and cut to the same can length as for the standard 307x113 container. The pieces are packed into the cans vertically in two layers. Hot 3 percent brine is then added, the cans are exhausted, sealed, and processed. So far as could be determined, the same process is given as for the 307x113 cans. It is understood that this pack is sold in the United States, principally to the "institutional" trade, restaurants, and drugstore lunch counters. It is labeled as bonito, brine pack.

Although bonito are taken throughout the year, it is only in the summer season (winter in the Northern Hemisphere) that the catch is large enough for the canneries to operate regularly. The canning season is from October through February, or in some years, March. Some of the larger plants then shut down, but the smaller canneries may operate on occasional days during the rest of the year when sufficient fish is available. A few plants with freezing space, freeze and store bonito for canning in the off-season. Yellowfin and skipjack are taken over about 10 months of the year, except during weather unfavorable to fishing. The largest catches are made, however, from November through March. A few bluefin tuna have been taken in the extreme north. Reports of albacore being taken off the coast of Peru are questionable. Specimens shown to me as "albacore" were identified as yellowfin tuna. "Albacore" is a common name for yellowfin tuna along some sections of the coast of Peru. Swordfish are also called "albacore" in some localities.

The range of the fishing fleet is limited. Most of the boats do not venture out more than 15 to 20 miles from shore, though some of the larger power craft go out farther at times. In spite of the present limited range, the average was even less in 1941, when it was estimated at about 10 miles. The fishery mission of that year found that there was a total of 87 motorboats of all types. With a few exceptions, these were open, not decked. There were 1,285 sailboats and 847 rowboats of various types. In 1950, the number of motorboats in the fishing industry had increased to 559. Most of these were decked, with a number of small purse seiners about 45 feet in length. There were also a number of combination boats which might be used either as sword-fishers half-ring net boats or purse seiners.

The bonito fishermen of the center coastal area, who operate out of Callao and nearby ports, are largely gill-netters. They go out about 4 o'clock in the afternoon and are almost always back in port by 9 o'clock in the morning. There are some half-ring nets and a few purse seiners, but the gill-netters union has been putting up a stubborn fight against the introduction of more efficient types of gear, and there are reports of slashed nets and other trouble. Gill nets and half-ring nets are in use in the north, while purse seines are being introduced. Hand lines and trolling lines are also important. They are used more by smaller craft, fishing for the fresh fish market. In the south, many of the bonito fishermen have half-ring nets or small purse seines.

The bonito are sold by count. The unit is a "docena" (dozen). This method requires more handling than is desirable. The fish are counted and thrown as they are caught, and are counted and thrown again before the fishermen land. They are counted and thrown onto the pier when the boats land. When the fish are sold, they are counted on the pier and thrown into truck bodies. They are thrown again from the trucks into receiving bins at the cannery. The excessive handling causes a good deal of bruising. In a load of mixed sizes, both large and small fish are sold at the same price. If there is a large number of small fish, a somewhat lower price is paid for the small fish. This is a cause of many disputes between fishermen and canners. The canners have difficulty in estimating recovery and costs from day to day because of this method. They would like to buy by weight. Sale by weight would stabilize returns to both fishermen and packers, but sale by count

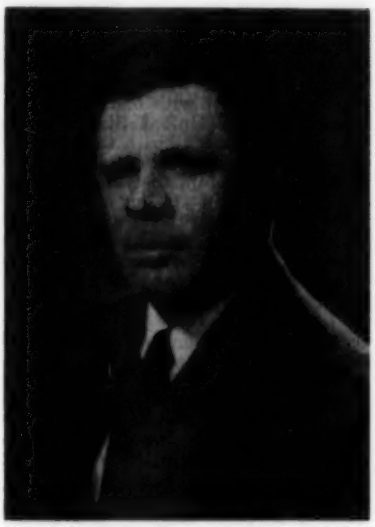
is such a long-established custom that it will not be displaced readily.

At only a very few ports is it possible to land the catch directly at the cannery. At Callao, the most important canning center, all fish are landed at the fishermen's wharf. Bonito may not be sold to the canners until buyers for the fresh fish market have supplied their wants. This applies to canners who own their boats. They have a theoretical right to the fish if the fresh fish buyers do not want them, but that is about all. There is supposed to be a legal, controlled price set by the government. If fish are at all scarce, this is not observed. In times of scarcity this year, bonito were offered at twice or three times the legal price.

The catch is all handled promptly and delivered at the canneries of Callao or Lima by early afternoon. I saw no stale raw fish delivered to the canneries, nor any stale or decomposed raw fish at any of the canneries, even those in which housekeeping was careless and sanitary conditions poor. It is believed that raw fish spoilage is negligible in the Callao area. The fish must be trucked from the fish pier, a minimum of a few hundred feet to the nearest cannery with a maximum of about eight miles to the most distant, in the Lima-Callao area. There is considerable long-distance trucking of bonito and tuna for canning, especially in the north. It is reported that the fish are not iced and have no protection. The roads are rough and haulage conditions poor. The possibility of raw fish spoilage in the north should not be overlooked.

In an unpublished report to the Food and Drug Administration, Mr. Clark stated that a number of the larger canneries were installing refrigeration rooms for the temporary holding of raw fish, with a few plants including sharp freezers and storage rooms for longer term storage. The freezing equipment was intended to handle surplus catches in the peak of the canning season, or for holding small catches until a supply had been accumulated sufficient for canning. This development has extended to all but the smallest operators. Even canneries of moderate size had installed freezing or refrigerator rooms and ice-making equipment, or were installing them in late 1951. In capacity, most of the chambers range from 10 to 50 tons. Three of the largest and newest plants have much larger capacity. Clark's recommendation that these rooms be used for holding precooked fish is being followed by a number of packers, especially where the fish could not be handled without long delay.

At most of the canneries, the fish are butchered on the cannery floor, or on makeshift benches. A few of the larger plants have fish bins and butchering tables of the conveyor type used in the United States. With some exceptions, butchering, and washing are not well done. As stated previously, most of the canneries do not have water-front locations. Fresh water is scarce over most of the coast. In some localities, the entire supply must be hauled by tank-truck for as much as 20 miles. Therefore, washing is held to a minimum. This may account for incomplete or careless cleaning, but does not excuse it. Offal and blood are allowed to remain in body cavities in the majority of canneries, even the largest and best-equipped. Incomplete gutting may be partially due to short labor supply in some of the larger plants. In several of these, it was my observation that the crew was not as large as in California canneries of comparable size, nor were the workers as efficient.



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The butchered and washed fish are stacked in wire mesh baskets of standard size. In a few canneries, they are then given an additional rinsing by water hose. The tuna cookers are of standard design, mostly holding from six to eight racks, and are equipped with pressure gauge thermometer, and bleeder valves. Some of the smaller canneries use two-car cookers. A number even use their retorts, the baskets being piled on top of each other, without using racks. Precooking is standard, and follows United States practice. In the majority of cases, it is well done, with the exception of the small canneries using retorts as precookers—where it is usually insufficient. Some canners overload the baskets with fish. In these instances, cooking may be insufficient. There is slow cooling, with occasional pack rejections for souring, and heavier losses from broken fish.

Precooked bonito are usually held a minimum of 16 hours for cooling, but tuna are held 24 to 48 hours. Mr. Clark reports that he found medium sized yellowfin tuna still rather warm after 24 hours. I found yellowfin tuna sufficiently cooled in 24 hours where artificial cooling was used. Some canners claim that slow-cooling is the reason precooked fish are allowed to stand 48 hours. My observation is that it is due largely to insufficient labor for cleaning the precooked fillets and the slow rate of speed in cleaning at most canneries. It is believed that slow-cooling has been the cause of spoilage of most lots rejected as adulterated by the U. S. Food and Drug Administration, or rejected for shipment in Peru. Blower fans are recommended for the cooler space, especially where refrigeration is not installed, or is impractical for cooling.

Trimming is done thoroughly. In fact in many plants it is probably done too thoroughly, with unnecessary loss of light meat. In some plants the cleaners are responsible for extra loss because of inept and careless handling. Exact figures on the recovery rates at different plants were not obtainable. Extended series of measurements and weights were not taken, but a short series of weights, together with observation and questioning, suggest that the bonito used in canning average 3.5 kilos (7.7 pounds) in the round, so that a rather low recovery rate would naturally be expected. Some light meat is lost unnecessarily in cleaning, and the recovery rate seems entirely too low. Average production is figured at one can of 48½'s per dozen fish.

The procedure in filling the cans does not differ from that used in the United States. The number of pieces in a can of solid pack is usually larger, owing to the small size of the fillets. Technique in filling is good in most canneries. The only criticism to be offered is a tendency to overfill with meat and skimp on oil. Oil is scarce and expensive. Peruvian Government regulations provide that for each gallon of oil exported, an equal quantity must be imported. Packers cannot afford to keep up a large inventory of edible oils. Consequently, they obtain their requirements on a short-term basis, and the oils are purchased in small lots of various kinds and qualities. So far as could be learned, imported cottonseed and soybean oil are used most extensively, together with some peanut and sunflower-seed oil. Sunflower-seed oil is made locally, and samples tested were of excellent quality.

Closing machines are of several types. Most of the larger canneries, and some of the smaller, are equipped with Angelus 75 machines, although

one plant in the south of Peru has American Can Company steam-flow closure machines. Most of the smaller plants use Max Ams semi-automatic or hand-closure machines. Some of the smaller plants use an Italian make, the "Mirca", which is semi-automatic.

There is considerable delay between filling and retorting, even in the most modern and efficient canneries. In the best plants, from two to three hours may elapse from the time the first sealed cans drop into the retort baskets before steam is turned on in the retort. In some instances, four hours are required to fill a retort. The delay in processing flakes is even greater. It ranges from four to six hours. It is a common practice in packing flakes to put the cans aside as they are filled and run all flakes through together at the end of the working day. Delay in retorting solid pack is due to several factors. Shortage of labor is an important cause. It is sometimes necessary to put all the women at work cleaning the fillets before it is possible to assign some of them to work at filling the cans. Also the fillers work very slowly. Another factor is that the retorts are too large for the rate of operation. Retorts are imported from the United States, where the speed of operation is more rapid. Peruvian canners are unwilling to process a partially filled retort, even though filled cans have been standing on the floor for two hours or more. At the average rate of operation, all retorts would have to be processed partially filled. Most of the canners could operate more efficiently with a larger number of smaller retorts.

Coding is used in all except the smaller canneries. The canneries using either of the inspection services seem to have fairly efficient coding systems. The codes are similar to those used in California. However, a parcel may contain a large number of codes, so that an individual code may represent no more than 30 cases. Most packers keep the codes well separated, but there are occasional lots where this is not true. A case may contain cans with three or four different code marks.

Retorts in the newest plants are equipped with automatic control and spray cooling systems. About half the canneries have recording chart thermometers. Gauges and thermometers are believed to be in good condition in the large and medium sized canneries and the retorts are properly vented. It is believed that in many of the smaller plants the retorts are not properly equipped, and that gauges and thermometers are far from accurate.

In most of the plants the cans are properly cooled and cleaned after processing. Much of the pack, especially from small and medium sized plants, is shipped with temporary labels to be relabeled by buyers in the United States. There seems to be an increasing amount of pack shipped with packers' and jobbers' labels in an effort to build up a market for packer brands and certain jobber brands. Nearly all the labeling is done by hand. A deterrent to this trend is that domestic labels are not yet of very good quality, and imported labels face a high rate of duty. Fiber shipping cartons of 100-point board are imported from the United States.

Tall cans are imported from the United States. Since the cans are not reformed, but shipped 48 to the case, this is an expensive container. Some of the so-called "7-oz. cans" (307x113) are also imported. Most of the cans of this size, the most important to the industry, are made locally by a firm which has a licensing arrangement with one of the can makers in the United States. The local establishment has a modern line of can-making machinery and one or more local machinists trained in the United States. It is understood that technicians from the United States also set up the line and trained the operating crew in Lima. Plate is brought in from the United States plain and is enameled at the factory in Lima. Cans from this plant were examined and found to be of good quality. Double seamer trouble is somewhat greater than in the United States. This difficulty is confined to the packers' end and is believed due to meddling by the cannery operators after the seamer has been adjusted.

The first export shipments were inspected only after arrival in the United States. Now canned bonito is inspected in Peru. Most of this is done by two private inspection services, operated by North Americans, with Peruvian assistants. Both are experienced tuna examiners. One at least is a former inspector of the State Bureau of Cannery Inspection in California. Cannery operators in Peru and brokers in the United States rely on these men. Most of the inspection work, including the cutting of samples, is done at the canneries. It includes a sanitation inspection modeled after that used in California fish canneries. In pack examination, it is the custom to examine 10 cans from each code. The results are reported in considerable detail and note is made of any item in workmanship or quality that should be brought to the packers' attention. If the lot would not be acceptable in the United States market, it is rejected. If it is acceptable, a certificate is issued. Firms refusing to follow recommendations given for improving sanitation or packing methods are refused certification.

What is the condition of the Peruvian canning industry today? It has serious problems to overcome. In my opinion the industry is overbuilt at present. Production averages 25 percent of estimated cannery capacity. The Peruvian coast is not the fishery bonanza it has been reported to be by some enthusiasts. Canneries have been built without regard for the essential requirements for cannery location such as availability of labor and fishing fleet harbors, water supply, transportation, and productive rate of labor.

At the present time, the Peruvian industry cannot compete in the United States market as successfully as the Japanese industry. While it is true that the cost of raw material is low, cans, cases, oil, and other supplies are much more costly, because they must be imported from the United States. What figures are obtainable indicate that the labor cost on a per case basis is higher than in the United States. While the hourly wage rate is low, the workers must be paid whether fish comes in or not. A greater number of workers is required for a given operation and the number of cases per hour is much less. Modern, well-equipped canneries comparable to any in California are doing pretty well when they pack 400 cases to a line per day.

On the basis of cost figures obtained from a reliable source, it is estimated that the cost of canned bonito at the factory, averages $5.85 U. S. per case of 48/½'s. This does not include hauling to the docks and loading, Peruvian export tax, ocean freight, U. S. import duty, brokerage or factory overhead, just the bare packing costs. At the time I left Peru, in December, 1951, it was estimated that the cost landed in New York averaged $9.25 per case.

The canning industry is not in good financial condition at present and has not been since 1948. Most canneries had been paying too high a dividend rate in the lush war and postwar period of 1944-48. Reserves are low or non-existent and a number of the canners, mostly small firms, but including a number of the larger installations are in financial difficulties. The green fish problem caused a considerable decrease in the pack of 1949-50 with severe losses to the industry. The next season, 1950-51, was more or less normal, but the current season is almost a total failure.

I believe that the Peruvian canning industry has sufficient raw material off the coast to pack some 2,000,000 cases of bonito and tuna annually without serious risk of depletion, but the fisheries are not limitless. We do not have enough knowledge of conditions along the coast to determine the fish runs at all accurately. Appar-

ently they vary greatly in amount and location. I believe that the present rate of production cannot be increased much over 700,000 cases without substantial increase and improvement in the fishing fleet, improvement in labor supply and labor productivity, and a better organization of the canning industry. The industry must attract more capital and set up substantial reserves. At the same time, increasing local demand will require a larger share of the catch. The law requires that no fish may be canned for export if there is a local demand for fresh fish. That is the condition of the canning industry in Peru today.

Negotiation of the Japanese-Canadian-United States Fishery Treaty

By Dr. W. C. Herrington, Special Assistant for Fisheries and Wildlife to the Under Secretary of State

Dr. W. C. HERRINGTON

The Tripartite Fisheries Conference, held in Tokyo, Japan, from November 4 to December 14, 1951, represented a vital step in a sequence of events which we hope will lead to the solution of old and persistent problems critical to the conservation of some of the major fisheries of the North Pacific and to the good relations between the three countries which participated. The North Pacific Fisheries Convention, which was drafted at the Conference and recommended to the Governments of the United States of America, Canada, and Japan, is to be signed and ratified as soon as the Peace Treaty comes into effect. This will mark the culmination of efforts to obtain recognition of our conservation programs and principles started by the fisheries interests of our northwest coast and Alaska 20 or 30 years ago and now brought to a successful conclusion through the cooperation of our Canadian and Japanese neighbors.

Some of the most important fisheries of the United States lie in the North Pacific Ocean. Salmon and halibut, the most important of these fisheries, were developed many years ago and were so much appreciated by the consuming public that the strong market demand led to intensive exploitation which at an early stage threatened the continued productivity of these resources. Extensive and expensive research probrams were developed by the United States and in the case of halibut and Frazer River salmon, by the United States and Canada, to determine measures required for maintaining the productivity of the fisheries. Stringent conservation measures were enacted and enforced which temporarily limited the income of many of the fishermen and in some cases caused temporary hardships, but this program in the long run served to maintain the resources at a high productive level and give the fishermen security in their livelihood.

The high level of productivity of these resources, brought about by the expenditure of money and effort by the United States Government and by restraints on our fishermen, has made them extremely attractive to the fishermen of other countries. The high yields which have been developed now would make it profitable for long-range fishing fleets from such countries to operate in our waters during the peak of the productive season, harvest a large share of the allowable yield, and then move on to other areas. Those who have had experience in the field of fishery conservation administration and regulation have consistently argued that it would be impossible to long maintain stringent conservation programs should these threats develop into active participation. Under such conditions the increases in productivity brought about by research, conservation management, and the restraints on fishermen of one country would be the primary factor in attracting fishermen of other countries to participate in these fisheries. Our highly-productive, conserved fisheries of the North Pacific have been increasingly subject to this threat as the result of the improvement in boats, equipment, and techniques which now make long-range fishing more efficient and profitable. The United States Government and industry, during the past two decades, have been seeking acceptable methods for giving encouragement to these conservation programs and for eliminating causes of friction between our fishermen and the fishermen of other nations who wished to fish in these waters.

Since the latter stages of World War II our fishing industry has hoped that limitations on Japanese fishing operations would be imposed upon Japan as a condition of the Treaty of Peace. Various measures have been proposed, such as restricting Japanese fishing operations to the seas west of the International Date Line or to waters more than 150 miles from our coastline. The Government of the United States, however, being concerned with all the varied interests of the fishing industry, promotion of international good will, rehabilitation of the Japanese economy, and maintenance of freedom of access to the unutilized raw materials of the high seas, has found it impossible to fit such proposals into our over-all international policies. It was further felt by some that the proposals went beyond what was required to meet the conditions necessary for encouraging the continued conservation of our fully utilized and conserved fisheries, and would provide a dangerous precedent for fencing off areas of the high seas. However, continued and intensive study was given this problem with the result that during the spring and summer of 1951 a new and promising approach was developed.

The idea which provided the key to a final solution was that the United States propose to Canada and Japan that in order to encourage the conservation and full utilization of fishery resources the three countries should recognize and agree upon certain principles and conditions and voluntarily abstain from exploiting stocks of fish when these conditions were fulfilled. The principles provided that when any stock of fish:

(1) was being fully utilized so that more intensive fishing would not result in a substantial increase in yield which could be sustained year after year,

(2) was the subject of a conservation program involving limitations on exploitation or other regulations for the purpose of maintaining or increasing its maximum sustained productivity, and

(3) was the subject of an extensive research program for conservation purposes

this situation should be recognized by any one or more of the three countries which was not sharing and had not recently shared in the exploitation of this stock and such countries

should agree to continue to abstain from sharing in the exploitation in order to encourage the continued conservation by the other country or countries.

This idea was incorporated into a draft which also included proposals for cooperative research on joint fisheries and regulation when needed, effective enforcement provisions, and a Commission to administer and supervise the provisions of the Convention. Provision was made for a high degree of flexibility to enable the Commission to handle both bilateral and trilateral problems and thus eliminate the necessity of negotiating additional fishery treaties among the three nations as new problems developed.

Because of the fact that some of the concepts involved in these proposals were new, it was necessary to thoroughly explore their possibilities and discuss their application with interested agencies of the United States Government and with the State Department's Advisory Committee from the Pacific Coast fishing industry. The proposals also were discussed with representatives of the Canadian Government.

Agreement was finally reached on the proposals in July, 1951, and inquiries were made with respect to the readiness of the Governments of Canada and Japan to enter into negotiations for a fisheries treaty on this general basis. Both governments answered in the affirmative, and the Government of Japan invited the United States and Canada to participate in a Tripartite Fisheries Conference to convene in Tokyo early in November. This invitation was accepted by both the United States and Canada.

There has been some discussion of the reasons for holding the Tripartite Conference in Japan. A number of considerations were involved in this decision. The primary one was that some of the conservation proposals to be made by the United States delegation would be ideas new to the Japanese Government representatives, fishing industry, and public. It was essential for the expeditious consideration of these proposals that the Japanese negotiators be able to confer quickly with the various groups for their reaction. It was also important that the Japanese Government and fishing industry, standing behind the regular delegation, have an active part in all decisions in order to promote acceptance of the final results of the Conference. The course of the negotiations fully justified these conclusions.

The United States fielded a delegation for the Tripartite Fisheries Conference well qualified to represent the fisheries interest concerned with the proposed convention. The delegation included four advisers from the Pacific Coast fishing industry and one from the fishery departments of the state governments of the Pacific Coast. The industry advisers were recommended by the Pacific Fisheries Conference and all were members of the State Department's Pacific Coast Fisheries Advisory Committee.

The other members of the delegation included the Special Assistant for Fisheries and Wildlife to the Under Secretary of State, the Assistant Director of the Fish and Wildlife Service, and the senior Foreign Affairs Officer from the Office of the Special Assistant.

Canada was represented by her Minister, Deputy Minister, and two other representatives of the Ministry of Fisheries, a member of Parliament, Canada's diplomatic representative in Tokyo, and an adviser from the fishing industry.

Japan was represented by her Minister of Agriculture and Forestry, Vice Minister of Foreign Affairs, Director General of the Fishery Agency, and a large delegation from the Fishery Agency and the fishing industry.

The negotiations themselves required considerably more time and perhaps were more strenuous than had been anticipated by most of the United States delegation, although probably the duration and intensity should not have been surprising, in view of the circumstances.

Fishing is one of the most important industries of Japan. The high seas contain resources upon which Japan relies increasingly, as only a few resources are open to further and expanding Japanese participation and exploitation. Furthermore, experience in Japan indicates that in conferences involving United States and Japanese participation with the difficulties of the language barrier, one should count upon triple the time that would be required where no such barrier is involved. Consequently, in view of the wide range of provisions to be covered by the proposed Convention, the newness of some of the proposals to the Japanese delegates and advisers who did not have the broad background of experience in international commissions and conservation programs possessed by most of the United States and Canadian delegates, it should not have been anticipated that negotiations could have been finished within a month's time.

The first week of the negotiations was required primarily for explaining and answering questions with respect to the United States proposals. The second week was taken up with explanation and questions with respect to the Japanese counter proposals. By the third week, the respective positions of the three delegations had become fairly clear.

All three countries wished to have a Fisheries Convention but the reasons why they desired the Convention were somewhat diverse. The United States desired a Convention to safeguard her major conservation programs in the North Pacific and to provide the facilities for friendly cooperative research and management of joint fisheries not now covered by treaties, in such a way as to avoid the friction and ill will between our fishermen and countries which occurred in the 1930's and threatened to increase with the expansion of Japanese fishing operations. Canada was primarily concerned with safeguarding her conservation programs without complicating or restricting her participation in the exploitation of stocks of fish along the adjacent coasts of the United States or complicating her past fishery relations with the United States. She did not anticipate any joint fisheries with Japan for some time to come. Japan desired a fishery convention to satisfy the terms of Article IX of the Peace Treaty, and to show her willingness to cooperate with other countries in fishery conservation programs, but above all to reiterate and strengthen her claim to the right of Japanese fishermen to exploit stocks of fish anywhere on the high seas.

Each delegation had specific limits on what it could concede to the others. Beyond such limits each would have preferred to take its chances without a Convention. From the third week on the negotiations provided a series of recurring crises as major issues were developed, hotly debated, and finally surmounted. The final crisis carried to within a few hours of the actual signing. Proposals and counter proposals were drafted and redrafted ad nauseam, in attempts to solve critical issues by changes in phraseology. However, no major issue was solved by words alone, although judicious selection and arrangement of words did ease the concessions and compromises when they finally came.

Acceptance of proposals was not made easier by the fact that in reality we were negotiating a fisheries treaty not alone with Japan and Canada, but also between Japan and each of the other countries of Asia. Every proposal was thoroughly examined by the Japanese in the light of its potential complications with each of these countries, for the Japanese believed, with some justification, that any concession or provision in the United States-Canada Convention might be demanded by each of the other countries. Any slight infringement on her free and equal access to the resources of the high seas she feared might be inflated by others until it became a hazard to her planned expansion of operations in

this area, the chief reservoir of natural resources still open to her.

The able Japanese delegation was particularly keen in catching the full implications in every proposal and counter proposal. They showed an overwhelming and sometimes exasperating preference, practically insistence, on phrasing everything in general terms subject, in our opinion, to a wide variety of interpretations. In contrast, the United States delegation constantly strove for precise terminology subject to a minimum of latitude in interpretation. We suffered from the usual American limitations on time. This made it necessary to press the issue on occasion, for time was not on our side.

During the last two weeks of the negotiations it appeared that the position of the Japanese, like our own, frequently was stretched close to the breaking point. The satisfactory reconciliation of all such points is a notable commentary on the ability of the delegations of all three countries to understand and appreciate the other fellow's viewpoint and problems, and willingness to search for an area of agreement which would enable us to reconcile our differences.

No account of these negotiations would be complete without a bow to the members of our delegation. If you are one of those who is glad to see the progress made, then you owe a vote of thanks to our advisers, Messrs. Ed Allen, Milt Brooding, Dick Croker, Don Loker, and Harold Lokken. Without them you wouldn't now have an agreed-upon and recommended North Pacific Fisheries Convention. We went to Tokyo with a set of proposals which had been drafted so tightly to get agreement among differing United States interests that there did not seem to be room for any further changes without losing needed support at home. Yet, to meet the Japanese and Canadian requirements and get an approved draft, it was necessary to dismember our draft almost completely and then salvage the most essential fragments and build a new structure. Without our advisers' knowledge of the problem, representation in the industry, and assistance in drafting and planning, it would not have been possible to proceed with the negotiations and have reasonable assurance that our work would not be repudiated back home. The other two members of our delegation, Milt James and Warren Looney, provided the heart of the delegation. Milt James' knowledge of treaties and governments, and his good common sense, and Warren Looney's knowledge of treaty language, procedure, and international law got us over many of the hurdles, and I hope will keep me out of hot water with our various government agencies. Ambassador Sebald and the members of his staff, particularly Richard Finn, who was assigned to our delegation, ably backstopped us throughout the negotiations. It is a pleasure also to recognize the yeoman service done by Mrs. Dorothy Peacock, secretary to the delegation, and Y. Munechika, our interpreter and advisor on things Japanese. One and all of the members of the delegation always delivered more than they were asked. I have never worked with a better team, both technically and personally.

The draft Convention finally developed and recommended to the three countries is, in my opinion, a good one from the point of view of each country. The United States gets the basic assurances we were seeking with respect to our major conservation programs in the North Pacific and a mechanism for friendly handling of future problems arising between us and the other two countries. Japan obtains recognition of her historical interests, assurance that she can reenter fishing areas without the friction with our fishermen which developed in the 1930's, a friendly means of handling fishing problems with the United States and Canada, and a Convention which will help rather than handicap her in negotiating fishery treaties with other countries. Canada obtains the reassurances she was seeking with respect both to her conservation programs and her fishing operations along the adjacent coasts of the United States.

Last, but possibly not least, the Convention includes for trial some new ideas which may be helpful in encouraging fishery conservation and full utilization programs. How they will work out, only time can tell.

Materials Management in the Production of Canned Fishery Products

By Dr. Spencer A. Larsen, Materials Management Center, Wayne University

World War II emphasized forcefully the importance, complexity and costs of materials handling, packaging, warehousing, loading, and transportation—when substantial portions of that war's production, feverishly produced with scarce manpower and materials, failed to reach its destination in usable condition.

E. H. Van Wagnen, now of General Motors Overseas Corporation (but in the military supply service during World War II) estimated that "losses of military goods arriving in Europe early in World War II were extremely high—nearly 50 percent. And in 1948, because of bad packaging and pilferage, one billion dollars was lost to exporters in the United States." Domestic shipments in peacetime likewise present a challenge when it is realized that for rail carriers alone loss and damage claims run upwards of $140 million annually—losses that must be added to the freight bills of business.

The need to improve the performance of these business functions was recognized in Detroit back in September, 1946, when the Transportation Committee of the Detroit Board of Commerce sponsored a packaging and materials handling clinic, its purpose being to give representatives of industry an opportunity to exchange ideas on improved methods of packaging and materials handling. It was evident from the large number of persons who attended, and who were interested in cost and labor saving ideas for industry, that an unfilled educational need existed. As a result we were prompted to introduce at Wayne University in the spring of 1947 a course in packaging and materials handling.

It soon became evident that the demand for such training was national as well as local. To meet this need our School of Business Administration, in the fall of 1947, joined forces with the Society of Industrial Packaging and Materials Handling Engineers to present, in Detroit, a week-long institute in packaging, materials handling, and transportation. A second institute was held in October, 1949. These two institutes attracted 525 executives from the nation's industries, and a half-dozen representatives came from foreign countries.

Similar institutes are now being held periodically in various sections of the country, and some 50 universities now offer courses in these fields—among them being Pennsylvania State College, Columbia University, the University of Pittsburgh, Temple University, the College of the City of New York, and the Universities of California, Wisconsin, and Minnesota. These institutes and individual courses are proving helpful, but time is proving them inadequate. They have, nevertheless, stimulated constructive thinking in industry and have emphasized the need for more complete materials management training programs.

A significant step toward the realization of this goal took the form of a recommendation from industry to Wayne University to activate the first

complete college program in materials management and leading to an appropriate college degree for those in industry and on the campus who complete the course of training. The recommendation was made on January 16, 1952, by representatives of commerce and industry and of the sponsoring organizations consisting of the Detroit Board of Commerce, the Society of Industrial Packaging and Materials Handling Engineers, the American Materials Handling Society, the American Society of Mechanical Engineers, the Material Handling Institute, and the Michigan Industrial Training Council.

At this important meeting, the initial contribution of $5,000 for the establishment of this research and training center was made by the Evans Products Company, Plymouth, Mich., by its vice president, Robert B. Evans. This company will contribute a total of $25,000 during the next five years to the Center. Approximately $75,000 a year, or a total of $375,000, will be needed to adequately finance the project through a developmental period of five years. The committee for the establishment of the center has agreed to obtain the necessary funds, over and above Wayne's contribution to the program, from businesses that will be important beneficiaries of this educational service. We do not anticipate any difficulty in obtaining these funds as voluntary offers approximating 50 percent of the total amount needed have already been indicated.

But what, you may ask, does this new program in education mean to the fishing products canning industry? Just this—the area of materials management: handling, packaging, product protection, warehousing, loading and transportation—are problems of real concern to all volume industries. And yours is indeed a volume industry. Moreover, these areas of activity accounting for 30 to 60 percent of the total costs of various industries, are now recognized as offering the most fruitful opportunities for lessening damage to goods and reducing labor costs and thereby contributing greatly to the maintenance of profits to business and an improved standard of living for our people.

And so my mission here today is to remind the Fishery Products Division of the National Canners Association of a relatively new label for a very promising cost-cutting crusade now getting well under way in America: "Materials Management."

Everywhere one looks—farms, mines, factories, mercantile establishments, transport companies—all are finding new and more efficient ways of packaging, handling, storing, loading, and transporting their products.

To present a more specific idea of the nature of this crusade—this new frontier for cost reduction—let us take note of a specific example:

The lead article in the *Wall Street Journal* on January 5, 1952, stated: "Three mechanical monsters the Denver and Rio Grande Western Railroad uses these days to dig the stones from beneath the rails, brush the dirt off them, and pack them back into place, cost the line $170,000. But these machines are enabling seven men to do the work of 165. But the road figures its cost saving every six months equals what it paid for the machines."

The canning industries take their place among the more progressive industries in adopting the new and better methods of materials management. But when I say to you that recent progress in methods of materials management is making obsolete a vast amount of investment in industrial plants, warehouses, and transportation systems, and retail and wholesale establishments generally, then I believe you will agree with me that surely the canning industry has yet unrealized opportunities for cutting overhead costs in the processing, packaging, handling, storing, and transporting of its canned products.

At the Gulf and Caribbean Fisheries Institute held November 12, 1951, Miami Beach, I said (and it wasn't challenged): "Obviously modern materials handling equipment cannot be used in conjunction with most existing plants and facilities of the fishery industries. And while many of you may think it a rash statement, nonetheless, the only hope I see of adapting many of these old dilapidated buildings to modern methods of materials management, is to tear them down and start all over again."

Fortunately your end of this great industry is not in the same sad condition as the fresh fish processing houses generally. Indeed some of your salmon, tuna, and sardine canning establishments are completely modern and alert to the better methods of materials management.

In this important regard, however, I doubt that you can pat yourselves on the back any more vigorously than our automotive industry—an industry that is quite aware of the magnitude of the new challenge facing it. In this industry there are now 750,000 workers covered by labor-management agreements that guarantee a yearly automatic wage increase of four cents an hour. This increase, commonly called the improvement factor increase, means a constantly rising labor cost—a cost, mind you, that can be offset only by a gain in productivity that reduces total production costs.

Do you wonder then that we in Detroit, and the automotive industry in particular, are taking this materials management challenge seriously—so much so in fact that leaders in the industry see in improved materials management the keys to future industrial success.

But let us return to the automotive industry and be more specific about some of the possibilities. Let us take the Ford Motor Company, a firm for which we have some definite dollars and cents information. This company spends over $42 million a year for material handling labor alone. This amounts to about 30 percent of its total labor cost—in an industry where materials management has already undergone considerable development and application of materials handling facilities.

Ponder, if you will, these statements made a few days ago by Del S. Harder, vice president in charge of manufacturing, Ford Motor Company, and Honorary Chairman of the Committee to establish at Wayne University the national center for research and training in materials management:

"In industry we have been inclined to think of increased productivity and lower costs in terms of greater automation of manufacturing processes. We have developed better and better machine tools. We have done more and more hand work by machine. We have used assembly lines, conveyors, and more efficient plant layout. But always we have been working actually with the manufacturing processes.

"We have been constantly *refining* our methods of production in an effort to keep costs down and certainly we are continuing to make progress in methods of machining and assembly, but there is no longer the opportunity in these areas for *major* cost savings. Tremendous steps forward like moving assembly lines and automatic machine tools are no longer before us. We must now look for our most important cost-reduction opportunities in another direction.

"I sincerely believe that in packaging, handling, storing, and transporting of materials lies one of our greatest opportunities for industrial progress. But let us not forget, material handling is in its infancy. It took World War II with its necessity for moving a tremendous volume of cargo and moving it fast to show us the great potential in industry of efficient material handling techniques. The Army and Navy helped develop these methods because time was the most important element they had to deal with, and time is important to us in industry, too, but for somewhat different reasons. We measure time

in dollars and cents. It is the very heart of our cost structure.

"Great strides have been made in reducing time and cost in materials handling—and it hasn't been easy. The men in industry who pioneered in introducing most handling techniques were up against a tough job of education. They were bucked by the labor unions on one side and by management on the other. Top management had been accustomed so long to the use of manpower in handling materials that they accepted the huge cost of that manpower as a necessary part of manufacturing overhead. The same management people who were quick to recognize the savings to be gained by labor-saving devices in and around their machines found the concept of saving time and labor in getting materials to and from those machines difficult to grasp.

"But most of them have been sold and more every day are being sold, by the dollars and cents facts about material handling, packaging, warehousing, and traffic. Here are a few examples from my own experience at the Ford Motor Company:

"Before we started our material handling program at Ford, we used to handle our scrap at the foundry by using laborers, wheelbarrows, and over-head crane dumping. It took 112 laborers, 100 wheelbarrows, and 12 cranes. Now, by using industrial power trucks and special hoppers, we do the some job with 36 people. We saved enough to pay for the equipment in approximately 80 days and we have been saving the Company over a quarter of a million dollars annually ever since in that operation.

"Another outstanding job was done in our gear and axle plant. Rough castings and forgings coming into the plant were thrown off trucks by handlers into large wooden bins. Other handlers placed the pieces on conveyors from the bins. Now, by using tub containers and loading directly into them from the trucks, we are able to do all subsequent handling with industrial fork trucks. This new method of material handling is saving us more than $50,000 a year.

"Here's another example of how material handling engineering pays off: The chassis springs we made at the Rouge plant used to be individually picked up at the end of the line and put on a conveyor that carried them to the freight siding. Then they were individually taken off the conveyor and loaded into the cars. And, of course, they had to be individually unloaded at their destination.

"Now we band groups of the springs on expendable skids at the end of the line and haul the skids to the freight cars with industrial power trucks. These trucks automatically stack the skids in the cars. The saving in this one operation amounts to around $56,000 every year.

"We've also found that automatic dock facilities for truck loading are saving us time and money. By using roller-equipped docks and equipped vans, we're able to load or unload 35,000 pounds of material in a van in something like ten minutes. It took us an hour and a half by the old loose-loading method, so you can see the kind of savings involved. And that doesn't include damage to truck beds caused by dragging heavy units over them."

Modern materials management is making for greater efficiency by increasing the total load carried at

SPENCER A. LARSEN

greater speeds; better correlated with production operations; stacking ceiling high so as to make use of the full cube of storage space; lessening damage and pilferage, lowering packaging costs; and lessening the time for taking physical inventory. All of these add up to lower overhead costs.

In principle, efficiency in handling depends to a large extent on the elimination of piece-by-piece manual handling in getting materials from place to place. This principle has found widespread adoption in what is commonly called handling in unitized loads. This type of handling is not practical in manual handling except to a very limited degree, i.e., that amount which a man can manage and carry. Handling of unitized loads ranging up to 40,000 pounds requires devices to support the load such as pallets, skids, and boxes which provide the basic support needed for industrial truck operation, whereas conveyors may be used to maintain a continuous flow of individual pieces.

In canned foods industries it is not unusual to see industrial fork lift trucks carrying 14 to 18 pallet-loads consisting of 50 to 60 cases each and weighing 2,000 to 4,000 pounds. With this kind of equipment trucks, trains, and warehouses are loaded and unloaded with a fraction of the time and the cost that the same job could be done manually.

As one observes various kinds of mechanical handling equipment in operation, he can hardly escape the conclusion that it is not engineering design and performance of handling equipment that is lagging so much as it is

(1) Unfamiliarity of handling equipment that is available; (2) lack of proper application of such equipment; and (3) failure of plant layout to accommodate itself to more efficient handling equipment and methods.

Top management in industry is coming to the realization that material handling in its many phases, must have equal status and equal responsibilities with plant layout, production engineering, industrial engineering, manufacturing research, and production analysis. Trying to relegate the material handling function to service-organization standing can only mean handcuffing an operation that could be your greatest potential for more efficiency and lower costs.

And traffic and transportation must play their part too, working with common carriers as well as customers and vendors, to make efficient material handling an over-all job.

The training of men to handle more efficiently these important functions is a job that's got to be done, and done by those who will benefit most from it —American industry. We have no books, we have no educators in the field. Most of what we know about material handling problems is in the minds and hands of men in the field, people who are doing the job today. But we've got to develop a program of training; outline subjects; and find people to teach them.

The handling, storing, packaging, loading and transporting of materials is becoming widely recognized as the new frontier in American industry. In these fields we shall find sources of increased productivity that will keep us the greatest nation on earth—that will keep our standard of living high, and our people free. Certainly a major contribution to this all important goal can be made by you, members of the canning industry.

RAW PRODUCTS CONFERENCES

Summary of the Discussions

Two conferences, designed to be of assistance to the agricutural departments of canning companies in helping them evaluate their own problems in the light of the most recent experimental research in their particular work, were held January 19 and 20. In addition to these scheduled programs, a smoker was held on one evening for those interested in agricultural problems at which some movies were shown of pesticide equipment in operation. The smoker also provided opportunity for those attending to discuss mutual problems in an informal atmosphere.

The first conference consisted of two panel discussions, one outlining the essentials of a successful tomato disease program and the other an evaluation of equipment for insect and disease control.

Successful Organization of a Tomato Disease Program

The leader of the discussion on organization of a tomato disease program was E. W. Montell of the Campbell Soup Company, who has had a great deal of experience in this field. Panel members were A. C. Moll, Stokely-Van Camp, Inc.; M. E. Webb, D. E. Winebrenner Co.; and S. G. Younkin, Campbell Soup Company.

The object of the discussion was to point out the problems involved in setting up a tomato disease control problem, including the education of field men, selection and purchase of equipment, whether canners or custom operators should own and operate the equipment and a comparison of the cost of these two methods. Some past difficulties encountered in putting this type of program into effect were discussed. Some very interesting points were brought out during the discussion which would be helpful to canners contemplating, or now operating, such a control program.

The members of the panel concluded that a tomato disease control program has paid big dividends in increased yields during the past five years and that quality of the tomatoes received at the factory has greatly improved.

An Evaluation of Equipment for Insect and Disease Control

The second part of the first conference, devoted to an evaluation of equipment for disease and insect control, was under the leadership of J. D. Barnard, who is in charge of agricultural research for the Green Giant Company. Panel members were Morton Adams of the Alton Canning Co.; A. L. Anderson of the Green Giant Company; A. C. Moll of Stokely-Van Camp, Inc.; W. C. Handwerk of the Campbell Soup Company; J. C. Chamberlin and Frank Irons of the USDA; O. C. French of Cornell University; and L. P. Ditman of the University of Maryland.

The object of this discussion was to bring out information which would aid in developing specifications for equipment to control insects and diseases more adequately than is now being accomplished. Mr. Anderson presented specifications which had been developed by agricultural specialists and engineers for high-clearance equipment for corn insect control. It was the feeling of the group working on this equipment that progress has been satisfactory and that a fairly good job of control is being done at the present time. Dr. Chamberlin, who is an entomologist at the U. S. Department of Agriculture station at Hillsboro, Ore., outlined the research program being conducted by entomologists and engineers in Idaho, Oregon and Washington, and presented extensive data showing the spray patterns of aerial applications with different types of booms and nozzles at different flight levels. He also showed movies and slides illustrating the application of insecticides, colored with dye, with this type of equipment. Dr. Chamberlin also presented performance data on a new type of duster which has given very effective control of pea aphis.

Prof. French of Cornell University presented an illustrated talk on a new type rotary mist concentrate applicator which is being developed at Cornell under the auspices of the engineering and entomology departments. A great deal of interest was shown in this new type of approach for applying concentrate sprays on row crops.

Mr. Irons of the USDA agricultural engineering and research laboratory at Toledo, Ohio, presented some of the fundamental work being done by that laboratory on evaluation of sprays and dusts under laboratory conditions.

Dr. Ditman discussed the work of the Maryland Experiment Station on different types of equipment for insect control, pointing out very forcefully that coverage of both the upper and under sides of foliage is necessary in controlling any insect.

Information was also presented by the agricultural specialists of canning companies outlining their experiences with tomatoes and beans.

It seemed to be the consensus of the panel that a great deal of improvement can be made in applicators for insecticides and fungicides, particularly on vegetable row crops. The apparent ineffectiveness of certain equipment seems to be due to lack of thorough coverage of both the upper and lower leaves of the plant. Most members of the panel seemed to believe that new ideas of design would be necessary to fulfill this fundamental requirement of equipment designed for control of insects and diseases.

On January 20 the conference also consisted of two panel discussions, one on chemical weed control on canning crops and the other on varietal performance of snap beans harvested with the mechanical bean picker. There was also an address on snap bean harvest and quality performance based on studies made at the University of Maryland.

Chemical Weed Control on Canning Crops

The panel on chemical weed control was composed of L. G. Holm of the University of Wisconsin; W. C. Jacob from Cornell University; Merton Miller of the Birds Eye Division of General Foods Corporation; and J. O. Young of Libby, McNeill & Libby.

Dr. Holm and Dr. Jacob presented the results of research work being carried on at experiment stations in the Midwest for control of weeds in such crops as peas, sweet corn, snap beans, lima beans, carrots, beets, and spinach. Mr. Miller and Dr. Young likewise presented data from both experimental plots and large-sized field plots in various areas where chemicals were used in the Midwest and East. The uses and limitations of a number of chemicals, based on the experience of many canners, were pointed out, and the need for canners to conduct pilot plant tests on their own acreage in order to determine the practical usage of herbicides was emphasized. The value of proper timing and placement when using chemicals for weed control was also brought out, and the point was made that use of this method of controlling weeds does not take the place of a good farming

program and the use of up-to-date agronomic methods. The influence of weather conditions and location on the critical performance of chemicals as herbicides was also brought out.

It was concluded that while chemicals may be a useful tool in the hands of experienced operators, the application of one-half or three-quarters of a pound of chemical per acre requires precise equipment and experienced crews in order to accomplish the desired results. Experience on the part of canners in the application of herbicides is essential, it was stressed, before such methods can be recommended to farmers.

Varietal Performance of Snap Beans Harvested with the Mechanical Bean Picker

The second panel discussion was devoted to the varietal performance of snap beans harvested with the mechanical bean picker, and the speakers were Mr. Adams of the Alton Canning Company and B. J. Miles of the Comstock Canning Corp. They covered the work done in New York last year on extensive varietal plots planted to determine the suitability of the different varieties and types of snap beans for mechanical harvesting. Mr. Adams pointed out that evaluation of the varieties was based upon only one year's tests and that no specific conclusions could be reached at this time from this experiment. It was shown, however, that certain types of bean plants, such as the Tendergreen type in green beans and Kinghorn wax in wax beans, were easier to harvest with the mechanical picker than the more prostrate types such as Ranger and Refugee.

The group which worked with this equipment feels that on the basis of these tests, coupled with observations from experimental plots, certain specifications for a bean plant can be given to the seedsmen and plant breeders for a variety which might be more satisfactory in the future for mechanical harvesting than some of the present varieties.

Dr. Kramer of the University of Maryland discussed snap bean harvest and quality performance and presented in his talk data on the yields which might be expected from one, two, three and four harvests. Quality of the beans harvested under these conditions was also discussed by Dr. Kramer. He pointed out that making only one harvest of beans will necessarily lower the maximum yield which might be derived from several pickings. Methods of determining the optimum time of harvest were discussed in some detail.

The Development of a Mist Concentrate Row Crop Sprayer

By O. C. French,
Cornell University

The acute shortage of farm help and the increased losses due to pests has been paramount in promoting improvements in the design of agricultural equipment for applying insecticide, fungicide and herbicide material. Considerable progress has been made, but there are still a lot of improvements necessary.

Discussion in this paper is restricted to the development of a mist concentrate row crop sprayer, its design features, and limited test results.

Development of the Sprayer

Research and field tests have shown that most insect pests can be controlled with a low gallonage, low pressure sprayer. However, this type of sprayer cannot be used for disease control because the high concentration of wettable powders will cause severe wear to component sprayer parts and will plug the small nozzle. It is also questionable that the degree of coverage necessary for disease control can be obtained with a hydraulic, low volume, low pressure sprayer. Therefore, the mist concentrate method of spray application offered the best possibility for a dual purpose, low volume, low pressure sprayer capable of both insect and disease control.

Design Features

The main design feature of this sprayer consists of a unique distribution outlet. In operation, a centrifugal fan delivers air to a turret head consisting of four round outlets and rotating in a horizontal plane. Air is discharged through these outlets during the forward 180 degrees of rotation, while liquid is injected into the individual outlets during 120 degrees of this forward rotation.

The liquid injection nozzles are located in the center of each air outlet. To handle the heavy concentration of suspended materials, these nozzles are spring loaded and self-cleaning.

Test Results

Field studies with this machine indicate that effective underleaf coverage may be obtained on a swath width of 18 to 20 feet. Biological tests for bean beetle control indicate that as little as five gallons per acre gives excellent results.

Chemical Weed Control in Canning Crops

By Walter C. Jacob,
Cornell University

The purpose of this paper is to summarize briefly the current status of weed control research on the various crops and to indicate any trends which may be evident for the future. To simplify the presentation the information will be given in outline form for each crop. Following this, some generalizations will be discussed.

Asparagus

In established beds spraying with 2,4-D at one pound per acre before cutting season and after cutting season has been recommended. Likewise the use of granular cyanamid at 300-400 pounds per acre pre-emergence or defoliant grade cyanamid at 75-100 pounds per acre post-emergence have been successfully used. New research is concerned primarily with the suitability of new materials and a search for better methods of grass control. Materials such as CMU, Crag No. 1, and potassium cyanate have shown promise in a few tests and seem worthy of more investigation.

For controlling weeds in seedling asparagus, various materials such as Stoddard's Solvent, PCP or DN have been used pre-emergence. Research is looking for selective chemicals to use on seedlings. Residual activity, which is important if a chemical is to give results over a period of time, must be increased in the chemicals used pre-emergence. To do this, materials must be found that are selective with respect to the crop.

Beans, Snap and Lima

Pre-emergence applications of DN and PCP materials have given good weed control for 3 to 6 weeks. These materials are quite safe for beans but they are relatively expensive. Materials of more selective action are desired and materials costing less are also needed. Such new chemicals as CMU, Crag No. 1, and FPC have shown some promise, and research is in progress to determine the best of these. Varieties of beans exhibit varying degrees of tolerance to chemicals and careful investigation should be carried out before large-scale trials are initiated.

Beets

Salt spray applications after the beets have 4 or 5 true leaves will control certain weeds and grasses with no injury to the beets. If lambs quarters is a problem, the salt spray is no good.

Also, most weeds are quite resistant to salt if they get too large before spraying. Research is concerned with screening new chemicals for pre-emergence use on beets. In this connection CMU and endothal have both looked promising in a few tests. All materials are also screened for selectivity and at present none has been satisfactory.

Carrots

Standard practice in nearly all carrot fields is spraying with Stoddard's Solvent to control weeds. Certain batches of oil have been sold for weed control when they were not so intended by the producer and injury has been noted. If agricultural grade oil is used, there is little likelihood of any injury. Research is now directed toward determining why some cultivation often improved the yield or quality of the crop with no differences in weed control being present.

Sweet Corn

Application of 2,4-D both pre- and post-emergence have been used on sweet corn. Soil type, variety, and climatic conditions seem to determine whether the 2,4-D will or will not injure corn. Cyanamid has shown good weed control under some conditions and not so good under others. DN materials can be used pre-emergence on corn with good results. The best chemicals for sweet corn depend on so many factors that only local recommendations should be followed. Research is aimed at screening new materials and trying to determine the cause for some injury that has been found in the corn. It seems that cultivation of some sort is necessary and the answer to just why is being sought.

Crucifer Crops

Cabbage, Cauliflower, Broccoli, Brussels Sprouts

No satisfactory chemicals have been found for these crops. TCA will control grasses with no injury to the crops but this use has not been tried extensively. The use of directed sprays of oils or other compounds is being investigated and new materials are being screened for selectivity.

Cucurbits

Squash, Cucumbers, Pumpkins

No satisfactory materials have been found yet. Certain contact materials such as oils and DN can be applied pre-emergence with little chance of injury to the crop, but the procedure involves several changes in cultural practices which growers do not like. Some new materials such as Crag No. 1 and PA have shown promise as selective herbicides. Much more work is needed before any materials can be recommended for trial.

Peas

Selective formulations of DN and cyanamid have been found satisfactory for weed control in peas. New materials are being screened to find something less harsh on hay seedlings. Small amounts of 2,4-D or MCP have controlled weeds with no crop injury. More work is needed on these materials before large scale trials are run. Work is also being done on the best stage of growth of the peas to spray. Also the influence of chemicals on quality is receiving attention.

Spinach

While there is no recommended practice, the use of IPC to control chickweed is being suggested. Certain new materials such as CMU and endothal show promise. It is possible under certain conditions to get satisfactory weed control with pre-emergence application of contact herbicides providing the weeds emerge before the spinach. This procedure has too little reliability to be used commercially now. Work is being done on this problem as well as screening new chemicals for selectivity.

Tomatoes

No materials have been found that are satisfactory for tomatoes. In field seeded practice it is possible to use contact herbicides as pre-emergence applications. This is erratic. On transplanted crops directed spray application of some materials might be used but no work is being done now. Some research should be started on tomatoes in the northeast.

Summary

From the preceding discussion, it is apparent that for only very few crops are good weed control chemicals available. Most other crops have much work to be done yet. The application of chemicals to weeds before the crop plants emerge is a very common practice but this technique is considered by many people as temporary until truly selective materials are found. It has often been stated that the cultivator is a thing of the past. The more we work on chemical weed control the more evidence is accumulating that there is some benefit from cultivation other than weed control.

Research is advancing rapidly in this field of weed control and many distressing problems should soon be solved. In the meantime, go slow with recommendations, let the research man find the limitations of a material or a method before putting it into large-scale use.

Following is a listing of the chemicals referred to in the text along with the name of the active material.

Name used in text	Active ingredient
CMU	3-(p-chlorophenyl) 1, 1 dimethylurea
Crag #1	Sodium 2,4-dichlorophenoxyethylsulfate
Cyanamid	calcium cyanamid
Cyanate	potassium cyanate
2,4-D	2,4-dichlorophenoxyacetic acid
DN	dinitro-ortho-secondary butyl phenol
Endothal	disodium 3,6-endoxohexahydrophthalate
IPC	isopropyl N-phenyl carbamate
MCP	2 methyl 4 chloro phenoxyacetic acid
PC	phthalamic acid
PCP	pentachlorophenol
TCA	trichloroacetic acid salts

Snap Bean Harvest and Quality Performance

By A. Kramer,
Professor of Horticulture,
University of Maryland

With the advent of a practical mechanical bean harvester, the problem now, more than ever, is: What is the loss in yield and/or quality if the beans are picked once only?

The factors of quality that should be considered from the raw product standpoint are: size, fiber, and seed content. With most varieties now in use, over 80 percent of all the pods reach size #5 or larger when the percent seed is less than 10, i.e., when they are still very young. With the exception of some of the older varieties, such as Black Valentine and Bountiful, there is little danger that fiber content may become excessive before seed content reaches an objectionable level. Hence, under most conditions, percent seed is the critical factor of quality.

The percentage of the potential yield that may be obtained with only one harvest drops from over 75 percent if the beans are picked at an average percent seed of over 16, to only approximately 25 percent of the potential yield if the beans are harvested at a stage of maturity when they average only 4 percent seed. Thus, if a standard quality product is acceptable, only 25 percent of the beans remain unpicked after one harvest; however, if a very young, high quality, product is desired, 50 to 75 percent of the beans remain unpicked after one harvest.

Because of the effect of other seasonal factors, heat summations are of only limited use in planning planting dates, and of very little use in determining dates of harvest. This can be accomplished satisfactorily by pretesting for percent seed.

CONVENTION RESOLUTIONS

Automatic suspension of price controls on any product that is in ample supply and whose price exerts no inflationary pressures was urged by the National Canners Association at its 45th Annual Convention.

The canners passed a resolution urging that standards be established for removal of price controls when goods are abundant and not creating inflationary problems, stating that most canned foods are in that position on the market today.

They urged the Office of Price Stabilization to promulgate regulations immediately that would provide for suspension of controls under such conditions and that decontrol standards be specifically clear, direct, automatically operative and based on economic fact.

The resolution dealing with standards for decontrol was but one of those reported by the N.C.A. Resolutions Committee. The report of the Committee was presented by Chairman Henry P. Taylor, who read the full text of the resolutions. They were unanimously voted and approved.

Price Control

Our economic system and national strength are based on the tenet that abundant goods can best be produced and sold at fair prices in a free economy. Only where unavoidable restraints upon production cause shortages in supply can there be temporary justification for the artificial, burdensome, and inevitably inequitable and complicated system of government price controls. The canning industry is convinced that the Office of Price Stabilization should immediately promulgate regulations providing for the suspension of price control on any product in ample supply where the prevailing price is exerting no inflationary pressure. Most canned foods are in this position. Standards for suspension of control shold be specifically clear, direct, and automatically operative. Their effective use must be based on economic fact, rather than upon administrative predilection, so as to permit appropriate Congressional review and any necessary legislative revision.

The Right to Meet Competition

Repeatedly, this Association has recorded the conviction of the canning industry that uncertainty in the legal rules governing the right of an individual seller to meet competition constitutes a threat to the economy. To impose limitations on the meeting of competition in good faith by individual sellers will inevitably result in economic maladjustment whose impact will fall upon the growers, workers, canners, and the communities in which they work and live. This Association is convinced that the public interest will be served and a free economy fostered by immediate and clear Congressional confirmation of the legal right of every seller in good faith to price his goods so as to be enabled always and effectively to meet competition in any market.

The Tripartite Fisheries Conventions

The National Canners Association has observed with great interest the negotiations of the Tripartite Fisheries Conference at Tokyo between the United States, Canada and Japan. The conference resulted in a draft of a Convention embodying a set of workable rules and regulations for the conservation and utilization of North Pacific fisheries. The Association commends the United States Delegation for its part in the negotiations and the drafting of the Convention and urges ratification by the United States Senate at the earliest possible date.

Appreciation for Speakers, Allied Trades and Press

The informative and timely speeches by our guest speakers, the cooperation of the allied industries and the coverage by newspapers, radio and the trade press contribute in large measure to the success of the Annual Convention. The Association is grateful for their invaluable contribution to the 1952 Convention and directs the President and Board of Directors to express to each of them its sincere appreciation for their effective cooperation.

Herbert J. Barnes

In the mirror of high office and demanding responsibility there is often reflected the true image of the man. During the past year of continued stress and persistent uncertainties, Herbert J. Barnes brought to the Presidency of this Association those personal qualities which he so uniquely typifies—equilibrium without weakness, conviction without arrogance, candor without discourtesy, and geniality without loss of purpose. His complete integrity, derived from his respect for sound principle independent of any crisis of the moment, his unaffected sincerity, and his penetrating insight into the problems of this industry have made his year of leadership both a valuable contribution to every canner and a pleasant privilege for those who have worked with him. To Herbert J. Barnes the Association expresses its gratitude for a trying task magnificently accomplished.

N.C.A. Staff

The imposition of a defense program on the nation's economy has created many new problems for the canning industry. The ever expanding scope of government controls and the many varied problems accompanying the mobilization effort have likewise made the Association's task of industry education, guidance, and representation a vastly more complicated burden. For the capable assumption of these additional responsibilities and the prompt and efficient performance of these emergency duties, the industry owes a vote of thanks to Carlos Campbell and his staff.

Necrology

With sorrow we pay tribute to those friends and colleagues who have died during the past year. In so doing we express our gratitude for their contributions to the industry and our appreciation of their friendship and the privilege of having worked with them. They will not be forgotten. Mournfully we here record the loss during the past year of

Col. Clifford C. Wagner
Frank E. Gorrell
Donald F. Larsen, Sr.
Dr. Ward Benjamin White
Dr. S. A. Rohwer
Ralph E. Sanborn
William H. White
George S. Bones
Frank E. Brewer
Harold K. Royal
Charles Carroll Caldwell
Frank W. Douthitt
Leland S. Argall
John T. Tenneson, Sr.
John Wilson Mount
Irving F. Lyons
George A. Bounds
William J. Foreman
Stran Summers
Heberton Lee Williams
Edward M. Brennan
Oscar T. Sewell
Carroll Lindsey

Call for 1952 Directory Copy

Forms on which canners are asked to submit information for the compilation of the 1952 edition of the *Canners Directory* will be mailed to all canners on February 5. It is urged that canners make whatever changes are needed to bring their *Directory* listings up-to-date, and return these forms to the Association promptly in the self-addressed, postage-paid envelopes provided.

Canners have been supplied the paragraphs showing firm name, address, plant locations and products, as they appeared in the 1951 edition, on a form designed to permit correction.

As in the past editions, the 1952 *Canners Directory* will list the name and main office address of each canning firm, location of factories operated by each firm in each state, and the canned food products packed by each firm within each state.

N.C.A. OFFICERS AND DIRECTORS

Fred C. Heinz Elected 1952 President of N.C.A.; Louis Ratzesberger, Jr., Elected Vice President

Fred C. Heinz, vice president of the H. J. Heinz Co., Pittsburgh, was elected 1952 President of the National Canners Association.

He succeeds H. J. Barnes, vice president of the Kaysville Canning Corp., Kaysville, Utah.

Louis Ratzesberger, Jr., president of the Illinois Canning Co., Hoopeston, Ill., was elected 1952 Vice President of N.C.A.

Carlos Campbell of Washington, D. C., continues as Secretary-Treasurer.

The N.C.A. membership elected 28 Directors to new terms; the terms of 44 members of the Board of Directors were held over.

Mr. Heinz has been prominent in mobilization planning by the N.C.A. During World War II he was a member of the N.C.A. Planning Committee, and today is a member of its counterpart, the War Mobilization Committee, in which he also serves as Chairman of its Procurement Group.

One of Mr. Heinz' outstanding contributions to the N.C.A. was to head the successful drive for contributions from canning industry supply firms to the million and a half dollar fund that made possible the new research and administrative headquarters building in Washington, D. C., and the new laboratory building in Berkeley, Calif.

Mr. Ratzesberger also has been active in mobilization planning activities of N.C.A. He is a member of the War Mobilization Committee and is Chairman of the Steering Committee for OPS Operations. He was a member of the Association's Board of Directors, 1946-48, and has been a member of the Statistics Committee since 1948. He served on the Labeling Committee in 1950 and 1951.

Report of the Nominating Committee

By John F. McGovern, Chairman

Your Nominating Committee met in a plenary session and labored diligently without benefit of nourishment, solid or liquid, until hunger and/or thirst enforced an adjournment.

The conscientious brothers who comprise the Committee, picked for their proven capabilities in deliberating matters of heavy moment, gave full heed to the responsibilities thrust upon them by reason of the critical nature of the times.

It was realized and repeatedly stated that unusual care in the selection of candidates must be exercised this year in order that the taint of gifts, air trips, yacht outings and such be not permitted to tarnish the crest of the N.C.A., thus far free from blemish, unsullied, and undefiled.

We chose, by unanimous agreement, from the ranks of the canning clan, members who were canners not only as producers but as consumers as well. Being consumers of canned foods exclusively, there would be no incentive for unsavory elements to tempt them with freezers.

The wives of most of them are either allergic to furs or prefer rabbit, mouton, and skunk to the overly-publicized mink.

It is my pleasure, therefore, as spokesman for the group, to report for your consideration the following names:

For President—Fred C. Heinz, H. J. Heinz Co., Pittsburgh, Pa.

For Vice President—Louis Ratzesberger, Jr., Illinois Canning Co., Hoopeston, Ill.

For the Board of Directors—

N.C.A. Board of Directors

Directors Elected to Fill Unexpired Terms

A. M. Erickson, Barron-Gray Packing Co. Div., Hawaiian Pineapple Co., San Jose, Calif.
J. W. Thuma, Sycamore Preserve Work Corp., Sycamore, Ill.
Charles O. Koller, Charles G. Summers Jr., Inc., New Freedom, Pa.

Director Elected for Two-Year Term

Grant Horsey, Wm. J. Horsey Co., Tampa, Fla.

Directors Elected for Three-Year Terms

H. L. Aukerman, Caar Canning Co., Redkey, Ind.
Berkeley A. Davis, Rogers Canning Co., Milton, Ore.
George H. Draper, III, Draper Brothers, Frederica, Del.
Edward R. Elwell, Burnham & Morrill Co., Portland, Me.
Leo M. Gleason, G & M Food Products, Des Moines, Iowa
George Gooding, California Packing Corp., San Francisco, Calif.
Robert A. Harris, Jr., Kinsale Canning Co., Kinsale, Va.
Henry W. Hartle, Owatonna Canning Co., Owatonna, Minn.
T. B. Holcombe, Indian Ridge Canning Co., Inc., Houma, La.
Grover Howard, Baron Canning Co., Westville, Okla.
Bradley T. Jones, Pictsweet Foods, Inc., Mt. Vernon, Wash.
George Lambert, Keystone Mushroom Co., Inc., Coatesville, Pa.
R. C. Lewis, Bordo Products Co., Winter Haven, Fla.
A. N. Meyer, Fredonia Canned Foods, Inc., Fredonia, Wis.
George Pierce, Fairmont Foods, Inc., Barker, N. Y.
D. T. Saxby, California Packing Corp., San Francisco, Calif.
Robert E. Searby, Hawaiian Canneries Co., Kapaa, Kauai, T.H.
P. K. Shoemaker, H. J. Heinz Co., Pittsburgh, Pa.
Victor R. Smith, Box Elder Packing Corp., Brigham City, Utah
Norman Spain, Winchester Canning Co., Canal Winchester, Ohio
A. O. Verbeke, Libby, McNeill & Libby, Chicago, Ill.
F. H. Walrond, Manteca Canning Co., Manteca, Calif.
D. B. Wood, Wood Canning Co., Stockton, Calif.
F. Hall Wrightson, Chas. T. Wrightson & Son, Inc., Easton, Md.

Directors Whose Terms Held Over

Frank Armstrong, Jr., National Fruit Product Co., Inc., Winchester, Va.
Floyd L. Asher, Clarksville Canning Co., Clarksville, Iowa
Charles H. Bailey, Monmouth Canning Co., Portland, Me.
E. R. Blackinton, Blackinton & Son Canning Co., Ogden, Utah
A. Edward Brown, Michigan Fruit Canners, Inc., Benton Harbor, Mich.
N. C. Buckles, Quality Food Products Co., Bradford, Ohio
J. Glen Brubaker, Hemet Packing Co., Hemet, Calif.
E. C. Christensen, Christensen Products Corp., Weslaco, Tex.
R. D. Cleaveland, The H. J. McGrath Co., Baltimore, Md.
S. R. Clevenger, Bush Brothers & Co., Dandridge, Tenn.
Mrs. M. F. Counter, The Fort Lupton Canning Co., Fort Lupton, Colo.
S. K. Ferguson, Lakeside Packing Co., Manitowoc, Wis.
G. E. Finch, Edgett-Burnham Co., Newark, N. Y.
Carleton A. Friday, Friday Canning Corp., New Richmond, Wis.
Robert A. Friend, Friend Bros., Inc., Melrose, Mass.
W. W. Giddings, Snively Groves, Inc., Winter Haven, Fla.
J. D. Hendrickson, Columbia River Packers Assn., Astoria, Ore.
Dale G. Hollenbeck, Thornton Canning Co., Thornton, Calif.
R. W. Jones, R. W. Jones Canning Co., Inc., Arlington, Ind.
Spencer R. Keare, Illinois Canning Co., Hoopeston, Ill.

Russell B. Kline, Stokely-Van Camp, Inc., Celina, Ohio
M. E. Knouse, Knouse Foods Coop., Inc., Peach Glen, Pa.
A. T. Leatherbury, Eastern Shore Canning Co., Inc., Machipongo, Va.
Stanley Macklem, Curtice Brothers Co., Rochester, N. Y.
Philip N. Mark, Tri-Valley Packing Assn., San Francisco, Calif.
Ivan Moorhouse, Olympia Canning Co., Olympia, Wash.
John F. O'Hara, Davis Bros. Fisheries Co., Inc., Gloucester, Mass.
John A. Owen, Pratt-Low Preserving Co., Santa Clara, Calif.
Reynold H. Peterson, Big Horn Canning Co., Cowley, Wyo.
E. I. Pitkin, Eugene Fruit Growers Assn., Eugene, Ore.
Paul H. Ploeger, The Ploeger-Abbott Co., Darien, Ga.
L. E. Shannon, Otoe Food Products Co., Nebraska City, Nebr.
James M. Shriver, The B. F. Shriver Co., Westminster, Md.
Russell M. Smith, Wilson & Co., Inc., Chicago, Ill.
John W. Speyer, Kauai Pineapple Co., Ltd., Kapaa, Kauai, T. H.
Angus G. Stevens, Stevens Canning Co., Ogden, Utah
Alfred J. Stokely, Stokely-Van Camp, Inc., Indianapolis, Ind.
Albert Vignolo, Jr., West Coast Packing Corp., Long Beach, Calif.
Lester Wass, Machiasport Canning Co., Eastport, Me.
Newlin B. Watson, R. S. Watson & Son, Greenwich, N. J.
Ernest M. Weisner, Gerber Products Co., Fremont, Mich.
Robert Wilson, Faribault Canning Co., Faribault, Minn.
Arthur W. Wittig, Port Ashton Packing Corp., Seattle, Wash.
J. Hollis Wyman, Jasper Wyman & Son, Millbridge, Me.

1952 Finance Committee

The personnel of the Finance Committee was approved at the General Session. As announced by President Heinz, it is as follows:

H. J. Barnes, Kaysville Canning Corp., Kaysville, Utah, *Chairman*
John L. Baxter, H. C. Baxter & Bro., Brunswick, Me.
E. B. Cosgrove, Green Giant Co., Le Sueur, Minn.
Howard T. Cumming, Curtice Brothers Co., Rochester, N. Y.
S. B. Cutright, Illinois Canning Co., Hoopeston, Ill.
Clinton W. Davis, Portland Packing Co., Portland, Me.
Ralph O. Dulany, John H. Dulany & Son, Inc., Fruitland, Md.
A. T. Flynn, Reid Murdoch Div., Consolidated Food Processors, Inc., Chicago, Ill.
William A. Free, Hungerford Packing Co., Hungerford, Pa.
Frank Gerber, Gerber Products Co., Fremont, Mich.
Walter L. Graefe, Pomona Products Co., Griffin, Ga.
G. Sherwin Haxton, Haxton Foods, Inc., Oakfield, N. Y.
W. U. Hudson, Gerber Products Co., Oakland, Calif.
Harold J. Humphrey, Birds Eye Division, General Foods Corp., New York, N. Y.
Marc C. Hutchinson, Michigan Fruit Canners, Inc., Fennville, Mich.
Adolph C. Ketzler, Bordo Products Co., Chicago, Ill.
H. F. Krimendahl, Stokely-Van Camp, Inc., Indianapolis, Ind.
D. P. Loker, French Sardine Co., Terminal Island, Calif.
R. G. Lucks, California Packing Corp., San Francisco, Calif.
John F. McGovern, Green Giant Co., Le Sueur, Minn.
George B. Morrill, Jr., Burnham & Morrill Co., Portland, Me.
Fred M. Moss, Idaho Canning Co., Payette, Idaho
Maxwell N. Naas, The Naas Corp. of Indiana, Portland, Ind.
Art Oppenheimer, Marshall Canning Div., Consolidated Food Processors, Inc., Marshalltown, Iowa
Robert C. Paulus, Paulus Bros. Packing Co., Salem, Ore.
E. N. Richmond, Richmond-Chase Co., San Jose, Calif.
H. N. Riley, H. J. Heinz Co., Pittsburgh, Pa.
Emil Rutz, Schuckl & Co., Inc., Sunnyvale, Calif.
R. L. Smith, Kuner-Empson Co., Brighton, Colo.
Henry P. Taylor, Taylor & Caldwell, Inc., Walkerton, Va.
H. L. Wedertz, Lakeside Packing Co., Manitowoc, Wis.
J. B. Weix, Oconomowoc Canning Co., Oconomowoc, Wis.
Oliver G. Willits, Campbell Soup Co., Camden, N. J.
E. E. Willkie, Libby, McNeill & Libby, Chicago, Ill.
E. B. Woodworth, Hawaiian Pineapple Co., Ltd., San Francisco, Calif.

Officers Elected by Other Associations

Officers of other trade associations, elected at their annual meetings during the Convention period, are:

Canning Machinery and Supplies Association

President—Hal W. Johnston, Stecher-Traung Lithograph Corp., Rochester, N. Y.; vice president—E. N. Funkhouser, Dewey and Almy Chemical Corp., Cambridge, Mass.; secretary-treasurer—S. G. Gorsline, Battle Creek, Mich. (reelected).

National Food Brokers Association

National chairman — Clarence Wendt, Allison & Wendt, Oklahoma City; first vice chairman—E. Norton Reusswig, Lestrade Bros., New York; second vice chairman— Willis Johnson, Jr., Willis Johnson Company, Little Rock; third vice chairman—George T. Neilson, A. H. Morse Co., Boston; member-at-large—Truman F. Graves, Graves-Chambers Co., Seattle; treasurer—Harry E. Cook, The Harry B. Cook Company, Baltimore (reelected); president—Watson Rogers, Washington, D. C. (reelected).

National-American Wholesale Grocers Association

President—French Fox, Fox Grocery Co., Charleroi, Pa.; vice presidents—V. J. Kurzweg, Jr., Consolidated Companies, Inc., New Orleans; Clemens G. Krekeler, Tomboy Stores, Inc., St. Louis; H. Spencer Marr, H. A. Marr Grocery Co., Denver; Robert Triest, Haas-Baruch Co., Los Angeles; chairman of the board—Sherwin A. Hill, Lee & Cady, Detroit; treasurer—J. Stanley Seeman, Seeman Bros., Inc., New York, N. Y.; executive vice president—M. L. Toulme, New York, N. Y. (reelected).

Old Guard Society

President—Walter Glascoff, Canned Foods, Inc., Waupun, Wis.; first vice president—Ogden Sells, San Jose, Calif.; second vice president—Harry Stansbury, A. K. Robins & Co., Inc., Baltimore; secretary emeritus, 1952—S. G. Gorsline, Battle Creek, Mich.; secretary, 1953—John Dingee, Crown Can Co., Philadelphia.

Young Guard Society

President—W. A. Free, Hungerford Packing Co., Hungerford, Pa.; first vice president—George Schanbacher, H. S. Crocker, Chicago; second vice president—Reid Jensen, Varnay Canning Co., Roy, Utah; secretary—Robert Eirich, H. S. Crocker, Baltimore.

The Forty Niners

President—Robert A. Sindall, Jr., A. K. Robins & Co., Inc., Baltimore; vice president—Mel Carlson, Food Packer, Chicago; secretary-treasurer—M. R. Feeney, Lansing B. Warner, Inc., Chicago.

Association of Canners State and Regional Secretaries

President—Calvin R. Skinner, Tri-State Packers Association, Easton, Md.; vice president—J. Overby Smith, Texas Canners Association, Weslaco, Tex.; secretary-treasurer—Paul Hinkle, Ohio Canners Association, Celina, Ohio.

MEETING OF N.C.A. DIRECTORS

The Board of Directors of the National Canners Association held its Convention meeting in Atlantic City, January 18, and took action—

Continuing the N.C.A. War Mobilization Committee as a Special Committee for another year to act for the Association in connection with all activities relating to the defense program, empowering the Committee also to act for N.C.A. through such subcommittees as it may create to effectuate this purpose.

Continuing also the Conference and Convention Committees as Special Committees.

Directing the President and Secretary to execute the renewal of the Consumer Claims Trust Indenture on or before February 15, 1952, and continuing the present trustees of the Fund—Marc C. Hutchinson, Emil Rutz, and Ralph O. Dulany.

Directing the President to appoint a Committee to study the broad problem of canning industry liability with regard to consumer claims and to report their conclusions to the Board at the next annual meeting.

Approving the recommendations of the Administrative Council as to the Association's budget for 1952 and continuing the current rate of dues.

Board Discussions

The Board members discussed various proposed plans for policies to govern future Conventions, after hearing a report by Chairman George B. Morrill, Jr., of the N.C.A. Convention Committee. This subject is more fully reported on page 15.

Following the report of the Finance Committee by Chairman Henry P. Taylor, the meeting was given over to defense program activities and Chairman Howard T. Cumming of the N.C.A. War Mobilization Committee called on several of the chairmen of the various war mobilization task groups for reports.

Pricing Problems

Louis Ratzesberger reviewed the work of the Steering Committee for OPS Operations, pointing particularly to Committee efforts to enable OPS to meet a target date of the last of February for completion of the 1952 canned foods price regulation. He reported on the fact that the industry had provided canner consultants to OPS who are presently working to assist the agency in its program of achieving a stabilized economy and in the timing of that program so that it will not be effectuated in such manner as to hinder canned foods production. The Committee has expressed the conviction, he said, that "when price regulations give insufficient consideration to the complexities of canned foods pricing and the problems of production peculiar to the industry, they become impediments to production as well as impediments to the achievement of effective price stabilization."

Manpower

John F. McGovern, Chairman of the Manpower task force, reported that the United States Employment Service forecasts a greater shortage of agricultural and rural labor for the coming season than prevailed this past year. He also discussed the sources of supply of foreign labor. In particular, Mr. McGovern reviewed the present status of legislative and administrative consideration of the Mexican national program for supplying farm labor. In this connection, he cited the agreement between the President of the United States and the President of Mexico that the present program would terminate in February unless Congress enacted legislation providing penalties for knowingly employing illegal entrants to the United States. Mr. McGovern invited delegates to the Convention to visit with USES officials at the office provided for them by the Association in the Traymore Hotel.

Procurement

Deliberations of the Procurement Subcommittee were reviewed by Chairman Fred C. Heinz and the following points were presented as the position of the group with regard to a military procurement program for 1952:

That military requirements be announced as minimum requirements, that the industry be assured the requirements actually will be purchased, that a Walsh-Healey exemption for the full calendar year is essential to effective procurement, that the procuring agency make every effort to remove inequities in the administration of a procurement program, and that further consideration be given to the desirability of a set-aside program and the possibilities of pre-season contracting.

Containers

Oliver Willits, reporting on the container supply status, reviewed the situation as to tin and steel shortages as they developed during the past year. The tin difficulty appeared to have been solved early in 1951, he said, with M-25 fairly satisfactory even though some food items had been put on a quota basis. Even though steel then got into short supply, M-25 was kept unchanged until the last quarter, at which time a number of canned items were cut 10 percent, and some as much as 30 percent.

Efforts have been made during the past months, he reported, to have the cut items restored, and while perhaps all would not be taken back to the October 1 basis, he expressed hope that the most important ones would be restored to a 100 percent basis. He advised the Board that any such changes would be brought about in the latest M-25 amendment, which he understood would be retroactive to January 1, 1952. (Mr. Willits' report was made the day before the M-25 amendment was issued. See page 24.)

Mr. Willits reported that NPA had informed him in Washington just before the Board meeting that a 5 percent cut clear across the board had been authorized for the second quarter. "We told them that the second quarter was the period when cans were made for perishable products, and they said they would try to have that 50,000 tons reinstated," he said.

Lead was also a most critical metal, Mr. Willits reported. Allocations to can makers were cut continually and stopped completely in November. Can makers were forced to obtain lead from abroad. Partial allocations have been resumed, Mr. Willits said, and the situation has improved somewhat.

He reported that questionnaires to ascertain the performance of coating restrictions had disclosed no failures due to the lighter weights. Another test will be made in the near future on shipments that have gone into warm climates.

National Situation

Chief Counsel H. Thomas Austern spoke to the Board on the subject of President Truman's recent State of the Union Message, pointing out that it is a sign of the times that the message was largely concerned with the "State of the World." Mr. Austern stated that few can accept the President's request that in the forthcoming election we argue about everything else except foreign policy. "Since the future of the country depends upon what happens abroad," he said, "this is something like urging that in the sale of goods one can talk about everything but the price. The President appeared to be talking as a man who knew that he could not get much done in the present session of Congress."

Reviewing the President's annual Economic Report, which Mr. Austern considers the "key document about the federal government," the speaker pointed out the federal budget will be about 85 billion dollars. "Of this, the armed services will get about $53.2 billion and military aid abroad will bring defense expenditures up to approximately $60 billion, leaving a mere $25 billion for the rest of the government."

The federal budget alone is approximately 25 percent of the total national product; adding state budgets you get up to almost 30 percent, and there is a whole school of economists who have pointed out that whenever taxes

get above 25 percent of a nation's income, that nation is invariably headed for run-away inflation, he argued.

The Economic Report makes a candid admission that for the fiscal year beginning next June, the government will spend $71 billion, will take in $63 billion—a deficit of $8 billion. "Hence, the President wants more taxes—not to make ends meet—but merely to cut the expected deficit. He wants $5 billion in new taxes; he wants it out of excises; he wants it out of the taxes on married people in the middle brackets. He wants it in an election year—and it is doubtful whether he will get any tax increases."

The Administration gives two answers whenever it is asked to cut expenses: (1) We dare not cut defense spending or foreign aid; and (2) the Budget Bureau already has cut the regular departments to the bone. Mr. Austern stated that he expects Congress will do some further drastic financial surgery.

He drew the conclusion from the Economic Report that in 1952 there will be plenty of food. In 1951 he reported, farm income was $17 billion despite the fact that many crops did not reach anticipated goals. This is compared with $13.7 billion in 1950.

Mr. Austern read the following comment from the Economic Report, which represents the President's reasons for continuing controls:

"But national economic policy may safely be based upon these assumptions: the progress of the security program will bring an increase in personal incomes and enlarge the potential market demand of consumers; the longer consumers elect to save rather than to buy goods, the larger will become the accumulated fund of liquid assets; and the fund of liquid assets, when coupled with the higher current income of consumers, will add greatly to the potential consumer demand, and may increasingly tend to turn potential demand into abnormally active buying.

"This is a precarious situation, and any day some combination of events could cause consumers to reverse the prudent attitude of recent months. It is essential that we maintain and perfect the policies which will effectively curb such an inflationary outburst."

Legislation

Brief comments were made to the Board on several items of legislation pending or about to be introduced. Chairman Walter Graefe touched on the Defense Production Act, the price provision portions of which are up for renewal in June, and reviewed the situation on the Walsh-Healey Act, reporting that the Army is considering what step to take next since their request for a full-year canner exemption was met with only a six-month extension.

Mr. Austern reviewed the history of S. 719 governing the opportunity to meet competition and the situation on chemical additives.

Robert B. Heiney of the staff gave brief reviews of war damage and water pollution legislation.

Hamilton Carothers and J. Harry Covington, of Association Counsel, spoke briefly on the subjects of the uniform commercial code and the *Jam* case, respectively.

N.C.A. Activities

The Directors heard reports on basic Association activities by President H. J. Barnes and Secretary Campbell, who gave assurance that the regular routine departmentalized service activities have been carried out, in even greater volume, despite the added burdens on the several Divisions that have been imposed by defense activities.

Convention Proceedings

(Concluded from page 17)

ceilings as a basis for 1952 ceilings, retention of low-end and other adjustments that were worked out during 1951.

Government Offices

With government controls so important a phase of program and other Convention operations, the N.C.A. saw to it that the government representatives were given accommodations and public locations in the headquarters hotel where canners could contact them. These offices were fully manned by government personnel and were extremely busy throughout the Convention period. Quarters were established for the Defense Fisheries Administration, Fish and Wildlife Service, National Production Authority, Office of Price Stabilization, Quartermaster Corps, State Department, Department of Agriculture, U. S. Employment Service, and the Veterans Administration.

Technical Sessions

In addition to the two General Sessions of the Convention, the Association conducted its usual series of special technological sessions. The N.C.A. Laboratories sponsored three of these: Saturday afternoon, January 19, and Sunday morning and afternoon, January 20, dealing with current processing and other production problems. Texts of papers delivered at these sessions are reproduced in the section beginning on page 30.

The Raw Products Research Bureau staged two conferences on Saturday and Sunday afternoon, respectively, and the Fishery Products Division held an afternoon conference on Sunday also. The Fish papers are reproduced in the section beginning on page 72 and texts of the Raw Products papers that were made available, along with summaries of the conferences, appear in the section beginning on page 82.

Publicity on Canned Foods

One of the important activities of the Association at the Convention was to give wide dissemination and publicity to the essentiality of canned foods and their economical performance in the market place. Charts prepared by the Division of Statistics were made available at the meeting rooms, the information centers, and at the N.C.A. Press Room, and were included in mailings made from there to 500 press, radio, wire services and magazines.

These subjects and others were covered in a special half-hour radio panel conducted by Philadelphia's Mutual radio station WFIL and broadcast Tuesday afternoon, January 22. On the panel, President Heinz spoke regarding essentiality of canned foods to the economy in emergency as well as normal times; Past President Barnes on the production record of the industry and its contribution to defense; Katherine R. Smith, Director of the N.C.A. Home Economics Division, reported on the general values and benefits the housewife finds in canned foods; Mrs. Marguerite F. Counter, of the Board of Directors, spoke on the special importance of canned foods right now to the housewife when so many of them are working in defense plants: Secretary Campbell related the performance of canned foods on the market place and emphasized that they are the housewife's "best buy."

The "best buy" story and canned foods essentiality also went out from Atlantic City over a national hookup. Don Hollenbeck, CBS news commentator, devoted five minutes of his morning broadcast on Wednesday, January 23, using material prepared for him in the N.C.A. Press Room.

These same points were made, along with others, in two invitational appearances of N.C.A. speakers to groups outside the organization. C. Meryl Sullivan, Director of N.C.A. Labeling Research, included them in his remarks to the Atlantic City Kiwanis Club on January 17, and President Heinz did the same, as well as emphasizing the management performance of the canning industry when he addressed the Atlantic City Rotary Club, Tuesday, January 22.

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